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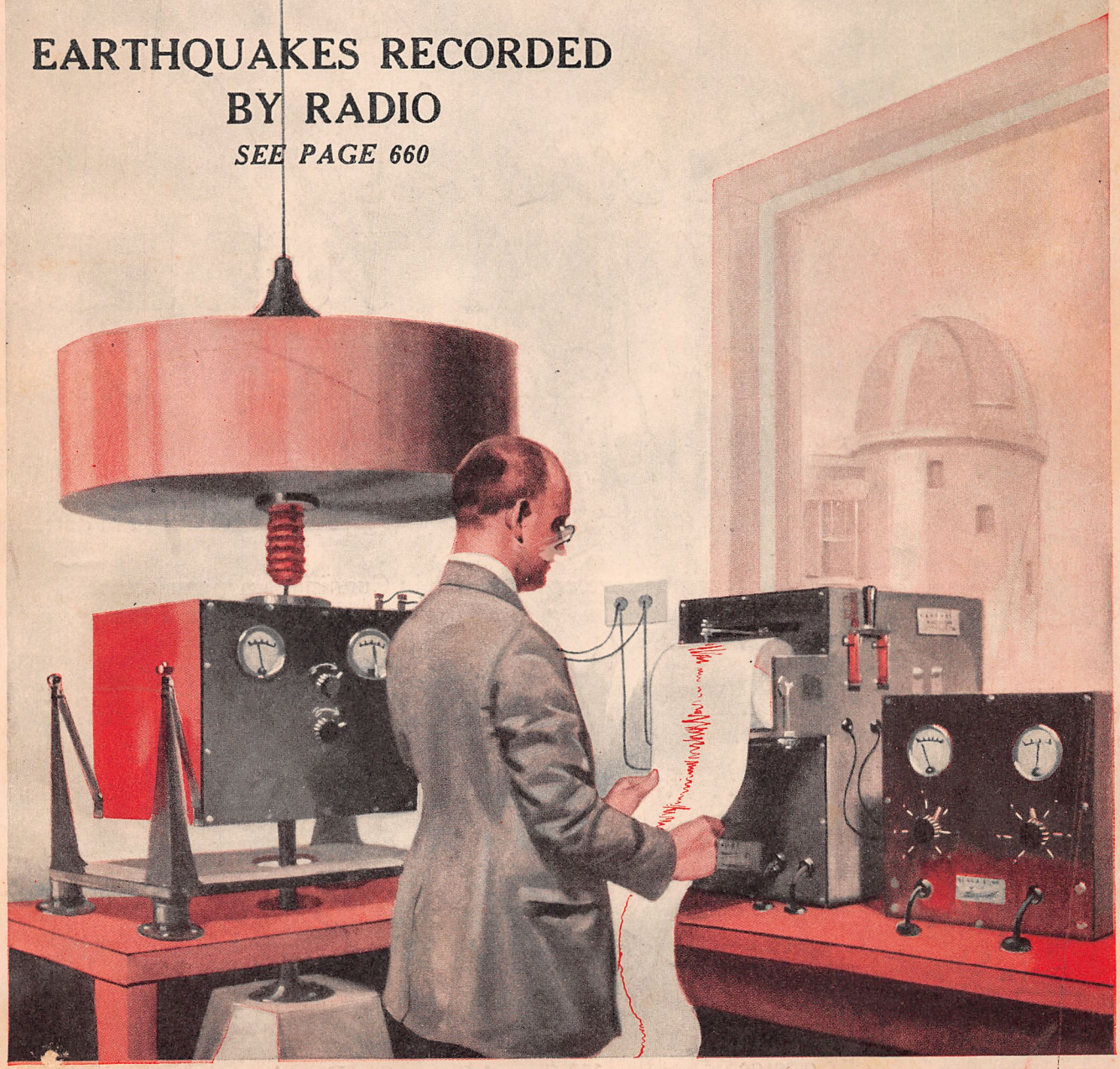

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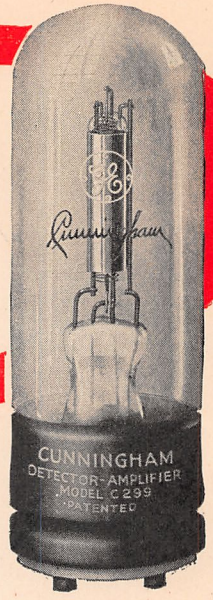

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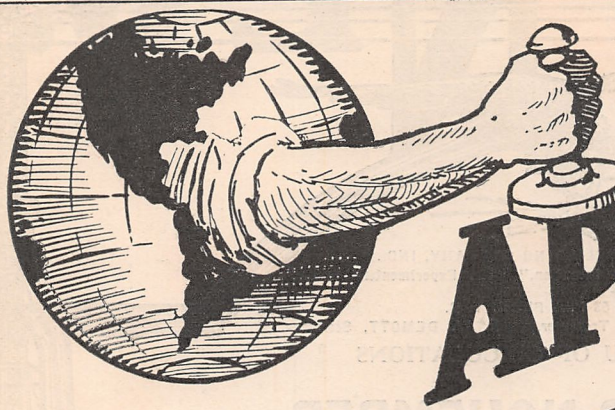

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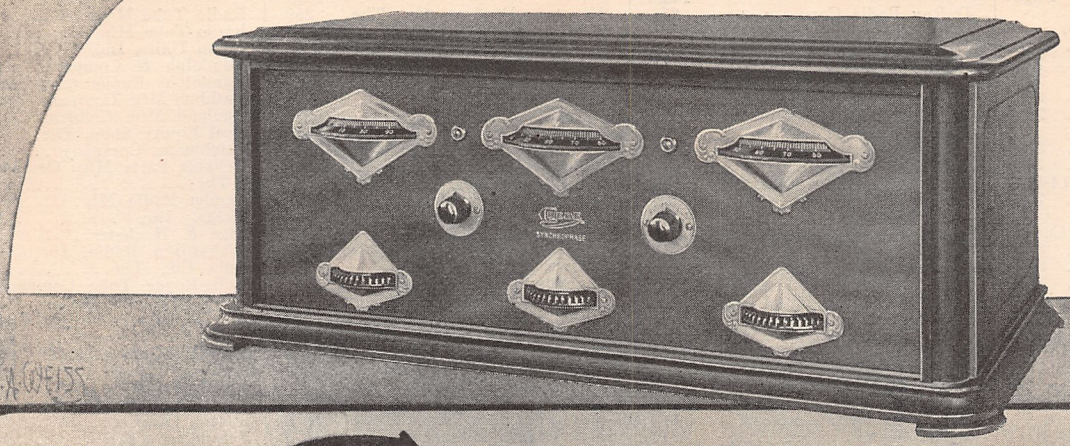

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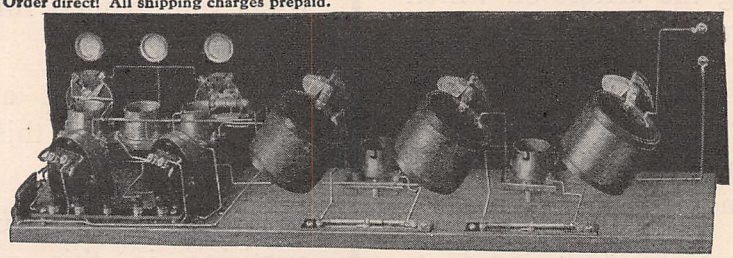

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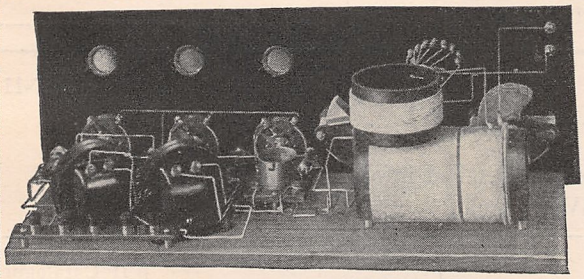
1 strip Bakelite, 6x1x3/16.

PARTS FOR 5-TUBE SET:
8 Binding Posts.
1 Grid Leak and Condenser.
2 Bakelite Sockets.
1 .001 Condenser.
1 Dubilier By-Pass Condenser.

3-Gang Bakelite Socket.
35 feet Hook-up Wire.
1 Wave Control Neutroformer.
2 R. F. Neutroformers.
1 Baseboard. **5-TUBE SET**
2 Neutrodons.
3 Bezels.

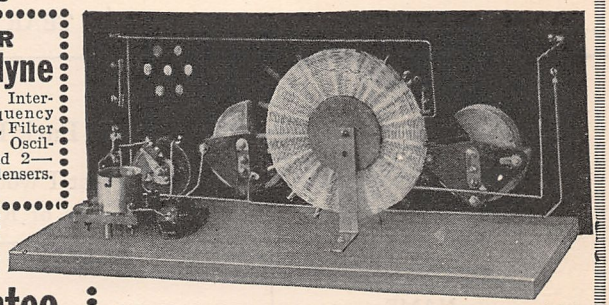
$43.75

Complete blue-prints and working diagrams and instructions.
PRICE—3-Tube Set, $26.45



SUPER Heterodyne
Containing 3 Intermediate Frequency Transformers, Filter Transformer, Oscillator Coil and 2—1 M. F. Condensers.

$19.75
with Audio frequency Trans. $26.65



COMPLETE PARTS FOR 3-TUBE COCKADAY RECEIVING SET

1 Cockaday Coil.
2 23-plate Hy-Grade Cond.
1 Bakelite Rheostat, 30-ohm.
1 Bakelite Rheostat, 6-ohm.
3 Bakelite Sockets.
1 high ratio Columbia or All-American Transformer.
1 Single Circuit Jack.
1 low ratio Columbia or All-American Transformer.
2 Double Circuit Jacks.
2 3" Bakelite Dials.
1 Grid Leak and Mica Cond.
7 Switch Points, 2 stops.
1 Bakelite Binding Post Strip.
8 Binding Posts.
1 7x21x3/16" Drilled Bakelite Panel. **3-TUBE SET**
3 Bezels.
1 Baseboard.

$19.95

Complete blue-prints and wiring diagrams.
1-Tube Set.....$10.45

Our Guarantee

Every article exactly as represented. Every article is tested before shipping. Complete satisfaction guaranteed or money will be cheerfully refunded.

PARTS FOR ONE-TUBE REINARTZ RECEIVING SET

1 7x18 Bakelite Panel.
1 Vernier Bakelite Rheo.
1 Bakelite Socket.
1 23-plate Lo-loss Var. Cond.
1 11-plate Lo-loss Var. Cond.
2 Bakelite Dials.
1 Genuine Rheinartz Coil.
2 doz. Switch Points and Stops.
3 Switch Levers.
25 feet Busbar Wire.
1 Freshman Grid Leak and Condenser. **1-TUBE SET**
1 Baseboard.
9 Binding Posts.

$10.45

Blue-print and Complete Instructions.
3-Tube Set.....$17.55

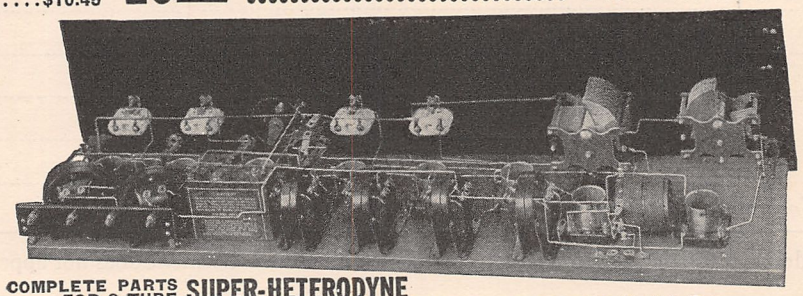
Complete Parts for
ACME 4-TUBE REFLEX

3 Acme A-2 Transformers
1 Acme R-2 Transformer
1 Acme R-3 Transformer
1 Acme R-4 Transformer
4 Bakelite Tube Sockets
1 Duplex or Bremer-Tulley Lo-loss 23-plate Condenser.
1 Frost Potentiometer-Rheostat.
1 .00025 Fixed Condenser with grid leak monting.
1 .0025 Fixed Condenser.
2 .002 Fixed Condensers.
1 .005 Fixed Condenser.
1 RW Crystal Detector.
8 Binding Bosts.
1 3" Bakelite Dial.
1 2-circuit Phone Jack.
1 length Spaghetti.
25' No. 14 Hook-up Wire.
1 50,000-ohm Grid Leak.
1 "C" Battery.
1 7x21x3/16" Bakelite Panel —drilled.
1 Baseboard.
Complete set blue-prints and instructions for wiring.

4-Tube Set

$39.85

1-Tube Set.....$17.45



COMPLETE PARTS FOR 8-TUBE SUPER-HETERODYNE

1 23-plate Lo-loss Vernier Bremer Tully or Duplex Condenser.
1 23-plate Lo-loss Vernier Bremer-Tully or Duplex Condenser.
1 400-ohm Frost Potentiometer.
2 6-ohm Rheostats.
2 30-ohm Bakelite Rheostats.
1 .00025 Fixed Condenser.
4 .002 Condensers.
1 .006 Condenser.
1 Bakelite Terminal Strip for Binding Posts.
1 Multicolucord Cable for connecting batteries.
1 1-Meg. Leak.
2 4" Bakelite Dials.
1 Single Circuit Jack.
2 2-Circuit Jacks.
8 x 35 Baseboard.
35 ft. Busbar Wire.
1 8x36x3/16" Dr'ld. Bak. Pan.
8 Bakelite Sockets.
7 Binding Posts.
1 Filter Transformer
1 Oscillator Coupler.
1 "C" Battery.
1 Battery Switch.
3 All-American or Columbia Long-wave Transformers.
2 All-American or Columbia Audio Transformers.
Instructions, blue-prints and complete layout.

$59.75

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BIG MONEY-SAVING RADIO CATALOG
containing a thousand bargains of everything on radio —parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. We will send catalog free.

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Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is free to our customers.

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IN every issue of RADIO NEWS you undoubtedly see numerous articles advertised about which you would like to have further information. To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

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This service will appear regularly every month on this same page in RADIO NEWS.

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Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

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Your own name here .....

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Address .....

City ..... State .....

LET ME MAKE YOU A RADIO EXPERT

YOU TOO CAN BOSS A JOB LIKE THIS AFTER TAKING MY COURSE

EARN $2500 TO $10000 A YEAR

$50 to $200 weekly are common incomes of Radio Experts, and thousands of Big Paying Radio positions are open to trained men right now everywhere. I GUARANTEE to Qualify you.

Big Money Comes Fast To You As One Of My Graduates.

I will tell you of many big positions—how to get them—when they will be ready for you—how much they pay—and show you how much money others have made and are now making under my Personal Direction. My book "Rich Rewards In Radio" is free to you.

I Train You at Home to Earn $12 to $30 Daily

Right now even my beginners in Radio are making good money daily. But my finished experts are all making from $12 to $30 every day, or they average over $200 every month. They hold the best positions as Radio Engineers, Supervisors, Chief Operators, Owners of Shops, Broadcasters, etc. $12 daily is easy to earn by making and installing. I invite you to be a $12 to $30-a-day-man—to work in a big-paying position for others, or to be Your Own Boss and work for yourself, setting your own hours.

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You can read and write! That is all that is necessary. My training is easy to Master, yet it brings so much more money than you can make at anything else because the field is so new—so big—and needs trained men so badly. The Course is so pleasant and interesting that you become so absorbed in the lessons and become an Expert—an authority on Radio—almost before you realize it.

Some Features of My Course That Make SUCCESS Certain

1. Practical Money-making Instruction—only.
2. Free Radio Parts Outfit. Finest Outfit for home experiment and use.
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5. Cash Refund Guarantee Bond.
6. N. R. I. is FIRST school to give Radio Instruction by Mail.
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These features are all explained in the big Free Book

My Radio Course is Based on 10 Years Experience

I, Myself, have made big money out of Radio as Director of Radio work for the past 10 years. I have helped hundreds make big money out of Radio. I have so perfected my Radio Course that it is impossible for you to fail to make $12 to $30 daily after completing my training. My Graduates are all over the world as Radio Operators, Broadcasters at big Land Stations, Building and Installing Radio Sets, etc.

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So sure am I that you can learn Radio Work—*so sure* am I that after studying with me, you too, can get into the "big money" class in Radio Work, that I will Guarantee under Bond to return every single penny paid me in tuition if, when you have finished my course, you are not satisfied it was the best investment you ever made.

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"Rich Rewards In Radio" is my free book unequaled for money-making interest. The Coupon below brings it to you by return mail together with other facts regarding Radio, which will amaze you. After filling out the Coupon just tear it off and mail it. Nothing more is necessary.

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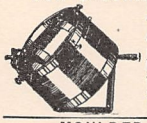
IT IS EASY TO BUILD YOUR OWN RADIO SET

Over 50,000 Barawik Radio Sets Are Operated All Over the World

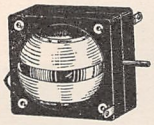
All of these sets were built with Barawik Standard Radio Parts mostly by persons without any previous radio experience. These home-made sets equal in results the best factory made sets—many are even superior and at a cost only a fraction of the cost of the factory made sets. You can easily equal these results.

OUR SPECIAL VARIOCOUPLER



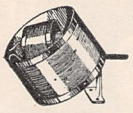
G418 Each $1.80
The most efficient type of coupler. Primary and secondary wound on bakelite tubes. Primary tapped for fine tuning. 3/16 inch shaft. Range 180 to 650 meters.

MOULDED VARIOMETER



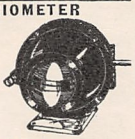
G412 Each.....$2.30
Polished black moulded rotor and stator forms. Maximum inductance with greatest efficiency and minimum distributed capacity. A high grade instrument that will get the best results. Wave length 180 to 600 meters.

EXCEL 180° VARIOCOUPLER



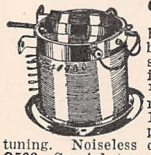
G521 Each.....$1.10
A wonderful value. Produces excellent results. Green silk windings. Rigid mounting support. Primary tapped for fine tuning. ¼ inch shaft. Range 200-600 Meters.
G522 Variometer—same style. Each.....$1.10

SUPERIOR VARIOMETER



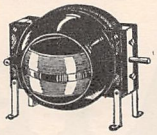
G525 Each.....$3.68
Forms moulded of red bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. ¼ inch shaft. Noiseless pigtail connections. Produces superior results in any type circuit 180 to 650 meters.
G527 Variocoupler. Same style. Primary tapped for fine tuning. Each.....$3.68

SUPERIOR VARIOCOUPLER



G523 Each.....$3.35
Stator tube and rotor ball of moulded red brown bakelite. Large size green silk windings insure highest efficiency. ¼ inch shaft. Superior results in circuits for 180 to 650 meters. Tapped primary for finest tuning. Noiseless contacts.
G526 Special type for single circuit Regenerative Hook up. Each.....$3.75

SPLIT STATOR VARIOMETER



G524 Each....$3.95
A wonderful value at our price. Polished black bakelite rotor and stator forms. Large size green silk wire insures greatest efficiency. ¼ inch shaft. Noiseless pigtail connection. Split stator winding.

SPIDER WEB VARIOMETER AND VARIOCOUPLER

G406 Variometer. Each.$3.95
G407 Variocoupler. Ea. 4.15
Sharp tuning, high efficiency and responsiveness to distant signals are features of these instruments due to absence of any insulating material in the magnetic field. Low energy loss. Secondary adjustment provides sharp tuning. Panel or table mounting. Complete with dial.

COTO COMPACT VARIOMETER AND VARIOCOUPLER

G408 Variometer. Ea....$4.10
G409 Variocoupler. Ea... 4.35
Small in size. Highly efficient. Unequaled for portable sets. Variometer measures 2⅞x1⅝x3¾ inches. Variocoupler 2⅞x3x3¾. Moulded bakelite forms. Silk covered windings. Table or panel mounting. ¼ inch shafts. Range 200 to 600 meters.

SWITCH LEVERS

Very neat polished composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch. 1¼ inch radius.
G381 With black knob. Ea.14c
G382 With mahogany knob. Each.....18c

INDUCTANCE SWITCH

G285 Price including knob and dial $1.18
Mounts switch points and contact lever behind panel. Only one hole needed to mount. 12 switch points, any number of which may be used.

SPIDER WEB COILS

G290— 25 turn 39c G292—50 turn 47c
G291— 35 turn 42c G293—75 turn 54c
G294—100 turn. Each 68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Firm green silk windings with mounting strips.

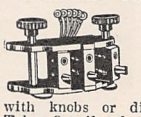
G299 Form for winding spider web coils 15c

INDUCTANCE COILS (Honeycomb)

Carefully made—fine looking coils. Low resistance—high self inductance. Very firm impregnation. Mounted coils have standard plug mountings. Specify when ordering whether mounted or unmounted type is wanted.

Tns	Art No.	Not Mtd	Mtd	Tns	Art No.	Not Mtd	Mtd
25	G301	$.28	$.75	200	G307	$ .66	$1.20
35	G302	.30	.90	500	G311	1.06	1.57
50	G303	.32	.96	1000	G314	1.64	2.18
75	G304	.37	1.02	1250	G315	1.86	2.35
100	G305	.52	1.07	1500	G316	2.10	2.50

INDUCTANCE COIL MOUNTINGS



G340 3 Coil.....$2.75
G341 2 Coil..... 2.35
Made of polished black bakelite. Mount on front of panel.
Back of Panel Mounting
Mounts back of panel, with knobs or dials on front of panel. Takes 3 coils of any size.
G342 Each $3.25

COIL MOUNTING PLUGS

Moulded of genuine bakelite.
G344 Plug for mounting "Honeycomb" coil 36c
G345 Plug to fasten mounted coil stationary to panel.....42c
G346 Movable plug to fasten mounted coil to panel so it can be rotated.....89c
G343 Fibre strip to hold coils for mounting. Two foot piece 15c

BAKELITE TUBING

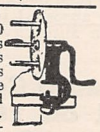
Genuine bakelite tubing. Pieces 3 inches long only.
G985 Inside dia. 2½ in. 29c
G986 Inside dia. 3 in....38c
G987 Inside dia. 3½ in.....42c
G988 Inside dia. 4 in.....47c

MAGNET WIRE

Prices quoted are for 8 oz. spools unless otherwise stated. Prices are prepaid.

Double Cotton White	Enameled	Wire Size	Single Silk Green	Double Silk Green
G990	G992		G991	G993
39c	31c	18	54c	75c
43c	35c	20	60c	82c
49c	39c	22	70c	95c
57c	45c	24	85c	$1.05
70c	50c	26	95c	1.30
95c	55c	28	$1.15	1.60
$1.15	60c	30	4oz. .80	4oz. 1.10
1.49	65c	32	4oz. .95	4oz. 1.30
	85c	36	4oz. 1.95	4oz. 2.60

COIL WINDER



G548 Each.....$1.90
For the set builder. Makes better coils in less time, saves its cost in short time. Clamps to table or bench. Has three adjustable fingers to hold tubes up to 4 inches diameter. Spring in handle prevents unwinding of coil when tension is released.

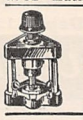
ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.
G730 Each.....89c

GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish.
G732 Each.....59c

FRESHMAN DETECTOR



G760 Each.....$1.10
A double adjustable crystal detector especially suitable for reflex and other sets requiring a high grade detector. For front or back of panel mounting.

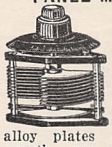
DETECTOR CRYSTALS

G736 Galena, Arlington tested, piece 19c
G738 Silicon, Arlington tested, piece 19c
G735 Tested Galena, Mounted, piece 9c
G737 Tested Silicon, per piece..... 9c
G739 Genuine million point crystal. Ea.29c
G733 Meteorite crystal. Each..... 12c
G734 Silver Clay crystal. Each..... 23c
G746 Dutec Crystal. Each..... 27c

STANDARD BRAND FIXED CRYSTAL DETECTORS

The latest developments in Crystal Detectors. Give better results and more reliable than old style. Used in Reflex circuits
G742 Grewol Detector. Each.....$1.10
G743 B Metal Detector. Each..... 1.39
G744 B Metal Crystal. Each..... .45
G747 RW Detector 1.29
G749 Brownlie Detector 1.79
G750 Brownlie Renewal ..... .69

PANEL MOUNTING VARIABLE CONDENSERS



These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts ¼ inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even reliable capacity. Dial and knob on vernier type. No dial on plain type. Our low prices save you money.

No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
3		G815	$.58		
5		G816	.97		
11	.00025	G814	1.13	G825	$1.95
17	.00035	G817	1.20		
23	.0005	G813	1.27	G824	2.30
43	.001	G812	1.40	G826	2.45

LOW LOSS VARIABLE CONDENSERS

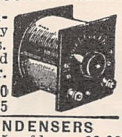
The latest type condensers. Reduce current losses increasing efficiency of set. Heavy aluminum plates. Vernier type has single vernier plate controlled by lever. ¼ inch shaft. 3 inch dial required for vernier type.

No. Plates	Max. Cap.	Plain Type No.	Plain Type Price	Vernier Type No.	Vernier Type Price
11	.00025	G836	$1.90	G833	$2.28
23	.0005	G837	2.12	G834	2.95
43	.001	G838	2.90	G835	3.80

LOW LOSS VERNIER VARIABLE CONDENSERS

G827 .0002 M.F. Each $1.95
G828 .0005 M.F. Each 2.30
G829 .001 M.F. Each 2.60
Highest grade instruments. Accurate rating. Extremely low dielectric losses. Independent friction vernier control insures perfect positive adjustment. ¼ inch shaft. No dial included. 3 inch dial required.

ENCLOSED VARIABLE CONDENSERS

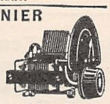


One of the best made condensers. Rigid, accurately spaced aluminum plates. Formica ends. Engraved scale. Knob and pointer.
G806 43 plate .001..$2.80
G808 21 plate .0005. 2.45

COTO VARIABLE CONDENSERS

G784 .00025 mfd. ...$3.90
G785 .0005 mfd. ... 4.18
G786 .001 mfd. ... 4.98
An unusually high grade condenser. Copper plates, soldered connections. Low loss type. Friction type vernier controlled by separate knob. Complete with dial.

SIGNAL LOW LOSS VERNIER VARIABLE CONDENSER

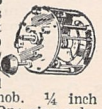


G802 11 plate .00025 $3.75
G803 17 plate .00035 3.95
G804 23 plate .0005 4.20
G805 43 plate .001 4.95
A condenser with many new, original features. Plates are brass soldered together. Hard rubber insulation. Friction drive vernier. Knob, pointer and etched metal dial for front of panel make striking appearance. Pigtail connections. Brackets on 17 and 23 plate for mounting radio frequency coils.

REMLER VARIABLE CONDENSERS

G820 .00035 mfd. Ea. $4.25
G821 .0005 mfd. Ea. 4.25
A new type of condenser. Each set of plates mounted on separate shafts which are geared to dial shaft. Plates fold into each other. Complete revolution of dial varies capacity from almost absolute zero to maximum rated. No other condenser has such a range. This feature especially adapts it to superheterodyne and other sensitive circuits.

ACME LOWEST LOSS CONDENSERS



G810 Each.....$5.10
Designed by Acme engineers for long service and efficient operation. Losses reduced to a minimum. Rotor plates supported on cast aluminum shaft. Enclosed in dustproof celluloid case. Friction vernier with knob. ¼ inch shaft. Requires 3 inch dial. One size only. Maximum capacity .0005 mfd.

ONE HOLE MOUNT

G832 Each.....20c
Only a shaft hole need be drilled in panel for mounting variable condensers when using this device. Saves drilling. Permits secure adjustment in any position.

DUBILIER MICADON TYPE 601

G502 .0001	.28c	G507 .0025	.32c
G503 .00025	.28c	G508 .003	.40c
G504 .0005	.28c	G509 .004	.40c
G505 .001	.32c	G510 .005	.48c
G506 .002	.32c	G511 .006	.60c

DUBILIER MICADON 601G

Same style condenser as above with mounting for tubular grid leak. No grid leak included.
G581 .00025. Ea.....36c
G582 .0005. Ea.....36c

DUBILIER MICADON 601T

Consists of a Type 601 condenser with brackets designed to fit over terminals on audio frequency transformers, binding posts.
G583 .001 mfd. 40c
G584 .002 mfd..40c G585 .0025 mfd..40c

FRESHMAN MICA CONDENSERS

G518 .0001 .....26c
G512 .00025 .....26c
G513 .0005 .....26c
G514 .001 .....31c
G515 .002 .....31c G516 .006.....60c
G519 .0025.....38c G517 .01 .....80c
G520 .005 .....60c G529 .015....$1.15

FRESHMAN VARIABLE GRID LEAKS

G177 Back of panel style.59c
G178 Back of panel style with .00025 Condenser....79c
G171 Base mounting type with .00025 Condenser....79c

C R L VARIABLE GRID LEAK

G173 Without condenser but arranged to take any standard grid condenser $1.05
G175 With .00025 condenser 1.35
Turning knob varies resistance from ¼ to 8 megohms.

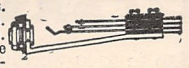
BRADLEYLEAK

Latest improved type.
G168 Without condenser, Resistance ¼ to 10 megohms ..$1.74
G169 With .00025 condenser 1.95

TUBULAR GRID LEAKS AND CONDENSERS

Cut shows leak or condenser mounted, but all parts are priced separately.
G849 Grid leaks (can be used with Dubilier 601G condensers) 10c
Resistances ½, 1, 1½, 2, 3, 5, 7 and 10 megohms. **Specify resistance.**
G831 Grid and Plate Condensers. Ea...29c
Capacities .000025, .0001, .00025, .0005. Specify capacity.
Mountings—Bakelite Base
G840 Single. Each.....15c
G842 Double. Each.....27c
G844 Triple. Each.....39c

SUPERIOR RADIO JACKS



Finest grade jacks.
Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels ⅛ to ⅜ in.
G390 Open circuit. Each.....32c
G391 Closed circuit. Each.....39c
G392 Two circuit. Each.....49c
G393 Single circuit filament control..46c
G394 Two circuit filament control....59c

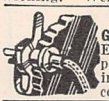
STANDARD JACKS

G387 Open circuit jack. Each.....22c
G388 Two circuit jack. Each.....28c
Well made, durable, smooth working, nickel finished frame. Well insulated.

NEW STYLE JACKS

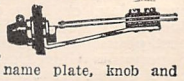
G379 Single circuit. Each..24c
G380 Double circuit. Each..49c
Occupy less space than other jacks. Binding posts, soldering unnecessary. Well made, durable smooth working. Well insulated.

CORD TIP JACKS



G389 Pair 20c
Eliminates expensive jacks and plugs. Mount on panel and insert headset or loud speaker cord tips. Nickel finish.

JACK SWITCHES

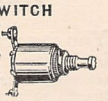


Compact and durable radio switches. Mount on panel same as jacks. Furnished complete with On and Off name plate, knob and pointer.
G280 Two springs. Usually used as "A" battery switch. Each.....57c
G281 Three springs. For switching from long to short wave, from one battery to another, etc. Each.....65c

RADIO SWITCH

G287 Each 25c
Cuts current on and off instantly by a push or pull. Very neat. Well made. Durable. Saves tubes and batteries.

SUPERIOR RADIO SWITCH



G283 Each 25c
A switch fully equal to any on the market at a price about half what is usually asked for a switch of anywhere near equal quality.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators 102 South Canal St., Chicago, Ill.

WITH BARAWIK STANDARD RADIO GOODS

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

G105 Detector UV200, C300. Each $3.59
G112 Amplifier, UV201A, C301A. Each 3.59
G118 5-Watt Transmitter. 7.70
G107 WD11, C11. Each.. 3.59
G101 WD12, C12. Each.. 3.59
G102 UV199, C299. Each. 3.59

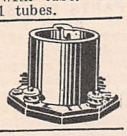
ADAPTERS

To use dry cell tubes in standard base sockets simply insert one of these adapters in the socket.
G104 For 199 or 299 tubes....43c
G109 For WD11 or C11 tubes 42c

C11 SOCKET

G136 Each 32c
Genuine moulded brown bakelite. Contact springs make firm contact with tube. For C11 or WD11 tubes.

BAKELITE SOCKET

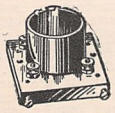


G140 Standard base ..29c
G141 UV199 base 29c
Moulded of genuine red brown bakelite. Binding post connections. Strong contacts. Real values.

EXTRA STRONG SOCKET

G142 Standard base 38c
G138 C299 Base 38c
Extra heavy. Square base. Double reinforced contact springs. For standard base tubes. A wonderful value.

PANEL MOUNT SOCKET

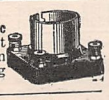


G143 Each 42c
The best socket value obtainable anywhere. Extra heavy, moulded, genuine brown bakelite. Double reinforced contact springs. Will mount on panel behind rheostat. Standard base.

THREE GANG SOCKET

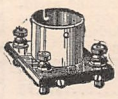
G144 Each $1.39
Extra heavy, moulded, genuine brown bakelite. Takes three standard base tubes. For base or panel mounting. Double reinforced contact springs.

METAL TUBE SOCKET



G134 Each 25c
Nickel plated brass tube set in best grade composition base. Plainly marked binding posts. An excellent value.

STANDARD TUBE SOCKET



G150 Single Gang...76c
G153 Three Gang..$2.25
Bakelite base. Polished nickeled tube. Highest quality socket on the market. Best insulation. Positive contact. Marked terminals. For base or panel mounting.

CUSHION BASE SOCKET

G145 199 Base 59c
G146 Standard base 75c
Moulded of high insulating material. Sponge rubber base. Non microphonic. Plainly marked binding post connections. Neat and compact.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending ⅝ in.

G370 Large size — barrel and knob ¾ in. long. Dozen ...70c
G372 Smaller size barrel and knob 9-16" long. Dz. 50c
G376 Large size with hole for phone tip or wire. Dozen ...80c
G378 Small size with hole for phone tip or wire. Dozen 35c

LETTERED BINDING POSTS

G375 Set of eight ...39c
Nickel plated washers. Composition tops lettered as shown in illustration. Eliminate engraving. Improve appearance. Sold in sets of eight only.

COMPOSITION TOP BINDING POSTS

G374 Dozen 45c. Hundred $3.00
Composition top, nickel plated body. 6/32 screw with washer.

SWITCH CONTACT POINTS

Brass polished nickel finish. Have ⅝ in. long size 6/32 screws and two nuts.
G363 Dozen....10c Hundred....75c
Thousand $6.75

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.
G365 Dozen....8c Hundred....30c

SWITCH LEVER STOP

Brass polished nickel finish.
G386 Dozen...18c Hundred...$1.05

YOU SAVE MONEY WHEN YOU BUY FROM US

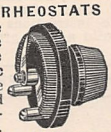
WE PAY TRANSPORTATION CHARGES IN U. S. EAST OF THE ROCKIES
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR
FAST SERVICE—TRY US AND BE CONVINCED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

SUPERIOR RHEOSTATS

G147 6 ohm 60c
G148 20 ohm 65c
G149 30 ohm 70c
One of the finest rheostats we have ever seen at a price that makes it the best value obtainable anywhere. Genuine bakelite base. Beautifully shaped black bakelite knob with white arrow. Single hole mounting. A rheostat you will be proud to have in your set.

FILAMENT CONTROL RHEOSTATS



G132 6 ohm. Each....32c
G129 20 ohm. Each....35c
G131 30 ohm. Each....38c
G135 6 ohm Vernier 78c
Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2⅛ in. Tapered polished black knob 1¼" diam. **Potentiometers.** Match above rheostats. Same high grade construction.
G151 200 ohm. Ea.58c G152 400 ohm. Ea.65c

FROST METAL FRAME RHEOSTAT

G161 6 ohm plain 50c
G162 6 ohm vernier 65c
G163 35 ohm plain 50c
G164 35 ohm vernier 65c
Nickel plated brass frame. Bakelite knob. **Single hole** mounting. Smooth action. Potentiometers to match above rheostats.
G165 200 ohm..50c G166 400 ohm..50c

AMSCO RHEOSTATS

A complete line of rheostats and potentiometers of the highest quality. Bases and knob are genuine bakelite. Flange and arrow on knob give same effect as a dial. Smooth action.

6 ohm G225 Plain $.85 G228 Vernier $1.28
20 ohm G226 Plain 1.05 G229 Vernier 1.49
30 ohm G227 Plain 1.10
Potentiometers to Match Above Rheostats
G230 250 ohm..$1.10 G231 400 ohm..$1.30

HOWARD RHEOSTATS

A well known line of rheostats and potentiometers that is giving very satisfactory service to its users. Complete with knob and pointer.

6 ohm G211 Plain 85c G212 Vernier $1.25
25 ohm G213 Plain 85c G214 Vernier 1.25
40 ohm G215 Plain 85c G216 Vernier 1.25
G217 200 ohm Potentiometer 1.25
G218 400 ohm Potentiometer 1.69
G347 6 ohm Midget rheostat .... .85
G348 25 ohm Midget rheostat .... .85
G349 40 ohm Midget rheostat .... .85

Single Hole Mounting Type with Dial

6 ohm G350 Plain 85c G351 Vernier $1.25
25 ohm G352 Plain 85c G353 Vernier 1.25
40 ohm G354 Plain 85c G355 Vernier 1.25
G356 200 ohm Potentiometer 1.30
G357 400 ohm Potentiometer 1.69

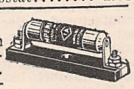
BRADLEYSTAT and BRADLEYOMETER

G208 Bradleystat. Each....$1.74
Latest improved type. Can be used with all types of tubes.
Bradleyometer
G209 200 ohm. Each $1.89
G210 400 ohm. Each 2.89

ACME POT-RHEO.

A rheostat and potentiometer combined in one unit. Does the work of two separate instruments. 300 ohm potentiometer.
G237 With 6 ohm rheostat.....$2.69
G238 With 30 ohm rheostat..... 2.69

AMPERITES



Eliminates rheostats on amplifier tubes where adjustment is not critical. Automatically adjust resistance according to flow of current, keeping tubes at proper point for maximum efficiency. Complete with mounting.
G221 For UV201A or 301A tubes.....95c
G222 For UV200 or C300 tubes.....95c
G223 For UV199 or C299 tubes.....95c
G224 For WD11 or C11 tubes.....95c

TINNED COPPER "BUS BAR" WIRE

Size 14 tinned copper wire. For wiring sets. Best size for neat job and easy soldering.
G957 Round. Ten feet for.....12c
G958 Square. Ten feet for.....14c

SPAGHETTI

For covering connecting wires in sets. For size 12 and 14 wires.
G955 Finest quality braided and saturated with best baked lustrous transparent insulating varnish, 3 feet for 19c
G956 Best quality braid and covered with black insulating compound. 3 feet for..9c

OUR SPECIAL A. F. TRANSFORMER

G549 3 to 1 ratio..$2.25
G550 5 to 1 ratio.. 2.45
In quality of tone and volume of sound, the things a transformer is built for we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect.

OTHER STANDARD BRAND AUDIO FREQUENCY TRANSFORMERS

Fresh, Clean Stock in Original Containers.
G587 Thordarson Ratio 3½ to 1 ...$3.30
G588 Thordarson Ratio 6 to 1 ..... 3.70
G589 Thordarson Ratio 2 to 1 ..... 3.95
G531 All American 10 to 1 shielded 3.80
G532 All American 5 to 1 shielded 3.80
G533 All American 3 to 1 shielded 3.60
G534 All American Push Pull. Each 5.10
G591 Modern 10 to 1. Each 4.50
G592 Modern Push Pull. Pair..... 9.90
G555 Federal No. 226. Each 4.45
G556 Federal No. 65. Each 6.35
G712 Radio Corp. Each 5.70

TRICOIL R. F. TRANSFORMER

G560 For 201A or 301A Tubes $1.58
G561 For 199 or 11 or 12 Tubes 1.58
This transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters.

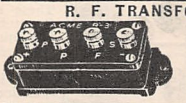
DUBILIER DURATRAN

G562 Each $3.48
A high grade, efficient radio frequency transformer that will give excellent results. Range 220 to 550 meters.

ACME TRANSFORMERS

G553 A. F. Transformer. Each $3.95
Acme transformers are well known to every radio fan. Made of best grade materials. Will give excellent service.

R. F. TRANSFORMERS



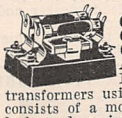
G565 R2 First Stage. Ea. $3.95
G566 R3 Second Stage. Ea. 3.95
G567 R4 Third Stage. Ea. 3.95

ERLA REFLEX PARTS
Genuine Erla Parts

G599 Selectoformer $3.95
G578 No.1 Reflex Transformer 3.95
G579 No.2 Reflex Transformer 3.95

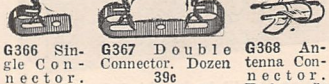
G597 6 to 1 Audio Transformer ...$3.95
G598 3½ to 1 Audio Transformer $3.95
G740 Erla Crystal Detector 89c

RESISTANCE COUPLED AMPLIFICATION



G570 1st Stage Unit $2.30
G571 2nd Stage Unit 2.30
G572 3rd Stage Unit 2.30
Amplifies without distortion. Replaces audio frequency transformers using same circuit. Each unit consists of a mounting with condenser, grid leak and resistance of proper value for best results.

FAHNESTOCK CONNECTORS



G366 Single Connector. Dozen 18c
G367 Double Connector. Dozen 39c
G368 Antenna Connector. Each ...8c
Handy and convenient for connecting wires or making connections on binding posts or other parts of instruments. Wires held firmly in spring grip but may be instantly removed.

VERNIER DIAL ADJUSTER

G941 Each 14c
Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.

DIXIE SCREW ASSORTMENT

G960 100 pieces screws and nuts 43c
Contains screws and nuts of size and style needed for assembling any radio set.

RADIO "BAKELITE" PANELS

We supply genuine Bakelite, Condensite Celeron or Formica, all of which have practically identical properties. Machines well without chipping. Won't warp. Waterproof. One side has attractive natural polished black finish which can be sanded and oiled. Other side mahogany finish. Either side may be used as front.

Panel Size Inches	⅛" thick Art. No.	Price	3/16" thick Art. No.	Price	¼" thick Art. No.	Price
6x 7	G450	$.55	G460	$.89	G470	$1.15
6x10½	G451	.86	G461	1.10	G471	1.60
7x14	G458	1.38	G468	1.73	G478	2.35
7x18	G453	1.78	G463	2.27	G473	3.15
7x21	G457	2.05	G467	2.65	G477	4.10
7x24	G459	2.42	G469	2.97		
7x26			G462	3.25		
9x14			G464	2.35	G474	3.15
12x14			G465	2.97	G475	3.98
12x21			G466	4.25	G476	5.70

RUBBER COMPOUND PANELS

Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch.

Black Art. No.	Price	Size Inches	Mahogany Art. No.	Price
G481	$ .70	7x10	G493	$ .85
G482	.85	7x12	G494	1.00
G483	1.00	7x14	G495	1.20
G484	1.25	7x18	G496	1.50
G485	1.40	7x21	G497	1.65
G486	1.70	7x24	G498	1.95

COMPOSITION DIALS

Handsome dials moulded in one piece of polished composition. 2 inch size has 270° scale marked 0 to 100 finely engraved in contrasting white enamel. 3 and 4 inch size have 180° scale marked 0 to 100.

Black No.	Price	Diam.	Shaft Size	Mahogany No.	Price
G921	16c	2"	3/16	G926	19c
G922	16c	2"	1/4	G927	19c
G923	22c	3"	3/16	G928	26c
G924	22c	3"	1/4	G929	26c
G925	27c	4"	1/4	G930	32c

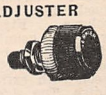
GENUINE BAKELITE DIALS

G931 2 in. Diam. for 3-16 in. shaft..35c
G932 2 in. Diam. for ¼ in. shaft....35c
G933 3 in. Diam. for 3-16 in. shaft...39c
G934 3 in. Diam. for ¼ in. shaft....39c
G935 4 in. Diam. for ¼ in. shaft. Ea.48c
Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Match perfectly.

UNIVERNIER CONTROL DIAL

G918 For 3/16 in. shaft, silver dial, black knob $1.10
G919 For ¼ in. shaft, silver dial, black knob $1.10
G916 Gold dial, mahogany knob for ¼ in. shaft. Each.....$1.29
Replaces ordinary knob or dial. Gives perfect vernier control on condenser, variometer, variocoupler, tickler, etc. Positive easy action. Looks fine. Easily installed. Especially desirable in tuning neutrodyne sets.

SUPERIOR VERNIER ADJUSTER



G942 Each 26c
Polished black knob. "Vernier" engraved in white. Spring adjustment. Need not be disassembled for mounting. Easily installed.

BEZELS

Finest quality. Fit any thickness panel.

Size In.	Nickel No.	Price	Black No.	Price	Gold No.	Price
¾	G904	15c	G907	16c	G910	28c
1	G905	15c	G908	16c	G911	28c
1½	G906	15c	G909	16c	G912	28c

PANEL ENGRAVINGS

G937 Per set 19c
A complete set of transfers in neat white lettering for marking connections, dials, etc. Easily applied in a few seconds. Look like real machine engravings, contrasts neatly on black or mahogany panels. Plenty of titles for the largest set.

BRASS ROD

Supplied only in 8 inch lengths.
G961 Threaded 6/32, per 8 in. length 6c
G963 Threaded 8/32, per 8 in. length 8c
G965 Solid 3/16 in., per 8 in. length 6c
G967 Solid ¼ in., per 8 in. length...9c

COPPER FOIL

G968 Per piece 25c
Thin copper foil for shielding panels. 6 inches wide, 2 feet long, .005 in. thick.

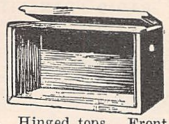
INSULATED BUS BAR WIRE

G959 Package of 5 3-foot pieces.....49c
Tinned copper bus wire insulated with highest grade varnished covering. 5 pieces, one each color—yellow, brown, black, green and red. Using different colors makes tracing of circuits easy and sure, neater and lower cost.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators. 102 South Canal St., Chicago, Ill.

BUILD YOUR SET BETTER--AT LOWER COST

CABINETS



Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Inside depth 7 inches except 9x14, 12x14, 12x21 which are 10 inches deep.

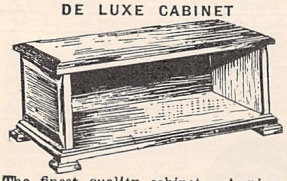
Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
6x7"	G420	$1.95	7x21"	G425	$3.25
6x10½"	G422	2.45	7x24"	G429	3.60
7x10"	G421	2.60	7x26"	G431	3.95
7x12"	G424	2.85	9x14"	G428	3.55
7x14"	F423	2.95	12x14"	G430	4.00
7x18"	G426	3.05	12x21"	G432	5.05

BASE BOARDS FOR CABINETS

Fasten to bottom of panel and fit inside cabinets. ⅜ inch thick, 6½ inches wide.

Art. No.	Length Inches	Price Each	Art. No.	Length Inches	Price Each
G435	6½	25c	G439	17½	33c
G436	9½	27c	G440	20½	35c
			G441	23½	37c
G437	11½	29c	G442	25½	39c
G438	13½	31c	G443	35½	50c

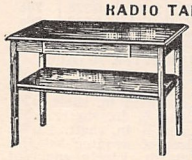
DE LUXE CABINET



The finest quality cabinet. A piece of furniture worthy of the best set. Made of genuine solid walnut in elegant hand rubbed brown finish. Top has piano hinge and lid support. Feet at base add to striking appearance. Inside depth 9 inches.

Panel Size	Art. No.	Price Each	Panel Size	Art. No.	Price Each
7x21	G445	$7.75	7x26	G447	$9.50
7x24	G446	8.25	7x36	G448	11.75

RADIO TABLE

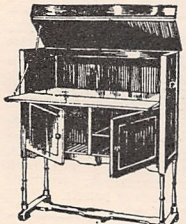


G901 Prepaid price, each, $8.25. Well made of hardwood in fine dark mahogany finish. Extra strong. Top large enough for any set. Shelf holds all batteries and accessories. Drawers for tools and tubes. Just the thing for the home or for displaying sets in stores. Top is 16 by 30 inches. Height 28 inches.

COMBINED RADIO TABLE AND LOUD SPEAKER

G903 Prepaid price, each $19.95. Holds set, batteries and accessories. A very fine loud speaker with grille opening in front is built just under the top. Speaker has unusually good tone and volume. Fitted with genuine Baldwin unit. Made of selected wood with extra quality antique mahogany finish. Top size 29 x 15 in. Height 29 in.

CONSOLE RADIO CABINET



G902 Prepaid price, each $37.50. A high grade piece of furniture. Neat appearance. Elegant finish. Looks well among finest furnishings. Roomy compartments hold any set with batteries, charger and all accessories. Can be entirely closed and locked. Very accessible. Strong durable construction. Paneled doors. Fine mahogany finish. Takes panel 7x33 in. or smaller. 37 in. wide, 14 in deep, 42 in. high.

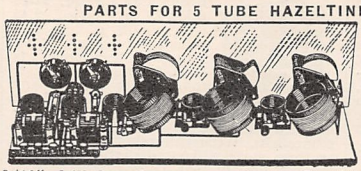
CABINET TYPE LOUD SPEAKER

G605 Prepaid price, each .....$12.50. A fine loud-speaker with a full rich tone and unusual volume. Amplifying chamber and unit enclosed in fine mahogany finished cabinet with silk backed grille front. Very convenient and better looking than most other types of speakers. A wonderful value at our price.

Complete Sets of Parts for Popular Circuits

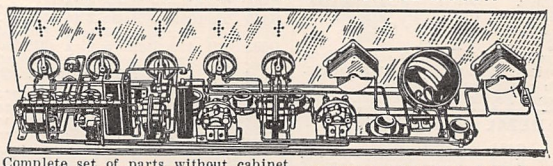
Only high grade parts are used in these sets and each part is guaranteed to be perfect. Each one of these circuits has been tried and successfully operated under many different conditions. The detailed instructions and diagrams supplied with each set make it easy for any one without previous experience to build an outfit that will give most satisfactory results. Parts supplied are for UV201A or C301A tubes throughout. If dry cell tubes are to be used specify type of tube in order and correct parts will be furnished without additional cost.

PARTS FOR 5 TUBE HAZELTINE NEUTRODYNE CIRCUIT



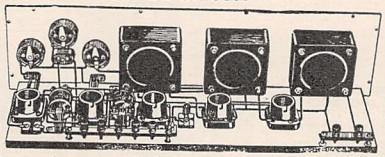
G858 Complete set parts, including mahogany finished cabinet .....$33.50. All the parts needed to build this circuit which is the leader of all circuits today. Tunes thru interference. Easy to find stations once they have been located. Brings in distant stations on the loud speaker in clear pure tones with wonderful volume. Essential parts licensed under Hazeltine patents. Genuine bakelite panel 7x24x 3/16" drilled ready to mount parts. Complete instructions furnished for assembling and wiring. With these parts you can easily build a high grade set at low cost. Note our price is prepaid.

PARTS FOR 8 TUBE SUPER HETERODYNE CIRCUIT



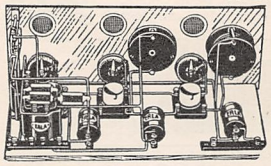
G884 Complete set of parts without cabinet .....$57.95. One of the newest circuits. Produces wonderful results when properly handled. This set requires careful construction and tuning and we only recommend it to persons who have had some experience in building sets. Designed to be used with loop. Brings in distant stations thru any interference, with good volume and with unusually clear pure undistorted tones. Best grade parts furnished throughout. Genuine bakelite panel 7x36x3/16" drilled ready to mount parts. Instructions furnished for assembling and wiring. Price is prepaid.

PARTS FOR 5 TUBE PHUSIFORMER CIRCUIT



G880 Complete set of parts, including high grade cabinet..$35.95. One of the easiest sets to build. Best results assured. Two stages tuned radio frequency amplification detector and two stages audio amplification. Brings in the distant stations with great volume and purest tones. Best grade parts furnished throughout. Genuine bakelite panel 7x26x3/16" drilled ready to mount parts. Complete instructions furnished for wiring and assembling. Transportation prepaid.

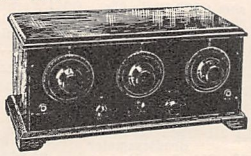
ERLA REFLEX CIRCUITS



G876 Complete parts, one tube set.....$19.75
G877 Complete parts, 2 tube set..... 27.80
G878 Complete parts, 3 tube set..... 34.90

These circuits have opened a new field in radio. One tube does the work of three in an ordinary set, two equal to four, three equal five. Crystal detector improves quality of reproduction, preserving the full mellow tones of the original. Easily handled, will bring in distance well. All parts are exactly as specified in Erla circuits. Panels are drilled for easy assembly. One tube set has 6x7 panel, two tube 7x14, three tube 7x18.

FRESHMAN MASTERPIECE SET



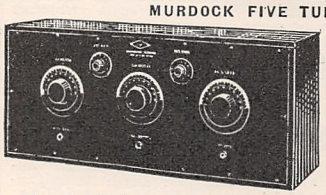
G860 Complete with tubes, batteries and accessories as listed below $97.00

A five tube tuned radio frequency set that brings in distant stations on the loud speaker with remarkable volume and excellent quality of tone. By careful arrangement of apparatus a panel 7x21 inches is used without crowding the parts. Engraved panel. Finely finished cabinet of attractive design. Highest grade parts throughout.

Our price includes the following: Set complete with cabinet, five genuine C301A or UV201A tubes, 100 ampere hour storage "A" battery, two 45 volt "B" batteries, one G613 special loud speaker and complete antenna equipment consisting of wire, insulators, lightning arrester, etc.

At our price this outfit is the best value obtainable anywhere. Note our price is prepaid. The price quoted is all you have to pay. Nothing else to buy.

MURDOCK FIVE TUBE NEUTRODYNE SET



G870 Complete with tubes, batteries and accessories as listed below .....$169.50. A high grade, genuine five tube Neutrodyne set at an unusually attractive price. Manufactured under the Hazeltine patents. Best grade parts assembled by skilled workmen insure highest efficiency. Engraved panel and finely finished solid mahogany cabinet lend richness and dignity to its appearance. Easy to tune. When station has been heard once and record made of dial setting you need only set dials at same point and if station is broadcasting it will be heard. Brings in distant stations loud and clear on loud speaker. Our price, which is transportation prepaid, includes the following: Set in cabinet, five C301A or UV201A tubes, 100 ampere hour storage "A" battery, two 45 volt "B" batteries, one Magnavox M4 loud speaker and complete antenna equipment consisting of wire, insulators, lightning arresters, etc. A high grade outfit for those who want the best.

FADA 5 TUBE KNOCK DOWN NEUTRODYNE SET

G857 Without cabinet $49.00

Consists of all parts necessary to build a high grade receiver capable of receiving over long distance. All parts are genuine Fada, well known for their high quality and efficiency. Parts include a 7x26 genuine bakelite panel drilled and engraved, baseboard for mounting parts, licensed neutroformers and neutralizing condensers (neutrodons). Complete instructions for assembling.

LICENSED NEUTRODYNE PARTS

G852 Licensed Neutrodyne Kit .....$14.95. Includeds three licensed Neutroformers, 2 neutrodons, panel layout, template and book of instructions for building up neutrodyne set. By adding other parts a neutrodyne set can be built at low cost.

TUNED RADIO FREQUENCY UNIT

G853 Each $3.10
Three for 8.25

Consists of radio frequency transformer wound on bakelite tubing and high grade variable condenser. For use in tuned radio frequency circuits. Usually used in sets of three. Condenser shaft ¼" diam.

BALANCING CONDENSERS

G854 Pair 70c

Sold in pairs for neutralizing the capacity in two-stage radio frequency circuits.

PARTS FOR SUPER-HETERODYNE

F885 Raven Super-Heterodyne Kit $22.50. Consists of one oscillator coil, one tuned stage transformer coil and three intermediate frequency transformers. Coil forms and transformer cases moulded of genuine bakelite. Book on Super-Heterodyne construction included.

REMLER SUPER-HETERODYNE PARTS

G887 Per set $22.00

Set includes one oscillator coil, one tuner stage transformer with condenser mountings attached, three Intermediate frequency transformers, and wiring diagram. These parts in circuit recommended have been built up into some very satisfactory sets.

BRANSTON SUPER-HETERODYNE KIT

G889 Per set $29.50

Contains the special parts necessary for a seven tube Super-Heterodyne set, an oscillator coupler, one tuned stage transformer, three intermediate radio frequency transformers and one antenna coupler. Panel layout and instructions included.

LARGE CAPACITY FIXED CONDENSERS

Tested for use in the new radio circuits. Metal cases. Soldering lugs for connections. Best materials. Carefully made.

G358 .25 mfd...55c G359 .5 mfd...$.65
G360 .1 mfd...85c G361 .2 mfd...1.35

SPIDER WEB COIL FOR REINARTZ CIRCUIT

G296 Each $1.10

A very unusual value. Made of green silk covered wire, spiderweb wound. 21 taps so arranged that crossing avoided. Mounting bracket permits various styles of mounting. Directions included.

G862 Complete parts for one tube set using the above coil. 7x18 drilled panel without cabinet $10.75
G863 Complete parts for three tube set without cabinet. 7x21 panel $17.95

COCKADAY PARTS

F298 Per set $1.65

Complete set coils for Cockaday circuit. Properly calculated and made to give best results in this new wonder circuit.

G276 Amplex grid-denser for Cockaday Improved 5 tube circuit.....$1.10
G277 48000 ohm genuine "Lavite" Resistances. Each.....$1.05

G873 Complete parts for one tube set using the above coil. 7x14 drilled panel. Without cabinet $10.25
G874 Complete parts for three tube set without cabinet. 7x21 panel..... 18.75

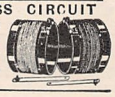
ULTRA AUDION PARTS

G297 Each.....$.85

Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strips and wooden rod for mounting and directions included.

G865 Complete set of parts for Ultra Audion one tube set using above coils $7.95
G866 Complete parts for 3 tube set $15.95

COILS FOR HARKNESS CIRCUIT



G295 Per set of two..$1.95

Green silk windings on genuine bakelite tubes. Properly calculated to give best results.

PHUSIFORMER

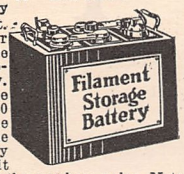
G546 Each $6.85

A new device especially designed for tuned radio frequency circuits. Consists of primary and secondary inductively coupled coils connected with variable condenser, all enclosed in moulded case with binding posts. Dial on shaft of condenser. Size 4½ in. square, 2 in. thick. Three units occupy small space and can be used to make up a very efficient 5 tube set at low cost.

THE BARAWIK CO. Chicago's Original Radio Supply House. Beware of Imitators 102 South Canal St., Chicago, Ill.

PRICES NOW ARE LOWER THAN EVER BEFORE

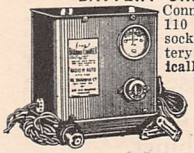
STORAGE "A" BATTERY



The best battery buy on the market. Guaranteed for three years. Made of best new materials. Full capacity. Try one of these batteries for 10 days. If at the end of that time you are not fully satisfied return it and we will refund the purchase price. Note our prices are prepaid. Transportation cost considered these are the lowest prices obtainable. We deliver this high quality battery to you for less than the cost of inferior batteries.

G194 6 volt, 60 amp. size. Each..$9.90
G196 6 volt, 100 amp. size. Each..13.25

BATTERY CHARGER



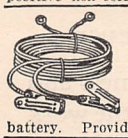
Connect charger to 110 volt 60 cycle light socket and your battery charges automatically over night at a cost of only a few cents. Cord and clips for connections included.

G201 For 6 volt battery.....$12.95
G203 For 12 volt battery..... 12.95
Noiseless Rectifier Bulb Charger—King, Tungar or Rectigon.
G255 2 amp..$15.95 G256 5 amp..$24.95

BATTERY CLIPS

G198 Two for 28c
Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.

"A" BATTERY CORDS

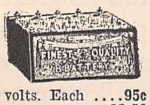


G191 Per pair 69c
Two heavy insulated stranded copper wires 5 feet long. Battery clip on one end and binding post terminal on other end. Eliminate shorting of "A" battery. Provide positive connections.

CONNECTING CORD SET

G192 Each 52c
Five connecting cords with braid over all. Each cord has distinctive colored covering. Terminals for connections. Makes connecting of both A and B batteries to set easy with no mistakes in polarity or voltage. Will reach from table to floor or for use in any type cabinet. Does away with unsightly wires.

PLATE CIRCUIT "B" BATTERIES



Reduced prices. A leading standard brand advertised to sell at much higher prices. No better battery made. Longest service.

G180 Small size 2 by 2½ by 3⅜ inches 22½ volts. Each 95c
Ten for $8.60
G184 Large size. 5 taps. Size 3x4x6½". 22½ volts. Each..$1.65 Ten for..$14.70
G188 Large size. 6 taps. Size 3x8x6½". 45 volts. Each...$2.90 Ten for..$27.90

G181 22½ volt. New upright size 3x2½x5½ in. Takes less space in set. Each.....$1.50
G183 45 volt upright size 3x7x 8 in. Each $2.90. Ten for $27.90
G185 New Jumbo size 45 volts. Height 7¾ in. Length 8⅛ in. Width 4½ in. Especially designed for large sets. Gives about twice the service of above battery. Each .....$4.45. Ten for $39.00

"C" BATTERY

G186 4½ volt C Battery size 4x1⅜x3 in. Each .....42c Ten for.....$3.95

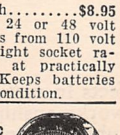
STORAGE "B" BATTERIES

G202 12 cells, 24 volts. Each $4.18
More economical than dry cell "B" batteries on sets using 3 or more tubes. Can be recharged when run down. Capacity 2500 milliamperes. A high grade battery. Glass jars with rubber caps. Strong moulded tray. Shipped dry so as to be mailable. No Electrolyte included. If electrolyte is not **obtainable locally** order below.
G204 Electrolyte for above (not mailable) 40c

"B" BATTERY CHARGER

G205 Each.....$8.95
Recharges 24 or 48 volt B batteries from 110 volt 60 cycle light socket rapidly and at practically no cost. Keeps batteries in good condition.

BATTERY METERS



G189 Each 82c
Reads 0 to 50 volts. Accurately tells you condition of "B" Battery. Convenient watch size. Tests 22½ and 45 volt batteries.
G193 Combination meter $1.30
Reads 0-50 volts; 0 to 25 amperes. Test "B" and "A" dry cells.

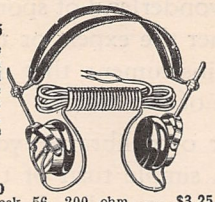
We Pay Transportation Charges In U. S. East of the Rockies

PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY
FAST SERVICE—TRY US AND BE CONVINCED
THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

BARAWIK QUALITY HEADSETS



G770 Per Set. 2000 ohms $2.35
These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. The receiver cases are fine polished finish with polished black ear pieces. Comfortable fabric covered head band. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them.

STANDARD BRAND HEADSETS

G772 Little Tattler Head Sets.....$2.60
G754 Baldwin Type C $8.95
G753 Baldwin Junior Headsets... 4.95
G764 Frost, 2000 ohm 3.30
G766 Frost, 3000 ohm 3.95
G751 Murdock 56, 200 ohm.....$3.25
G752 Murdock 56, 3000 ohm 3.90
G768 Brandes Superior, 2000 ohm 4.95
G769 Brandes Navy, 3000 ohm.... 6.95

OUR SPECIAL LOUD SPEAKER

G613 Each $6.75
Careful tests have proven this speaker to be equal in quality of tone and volume to most speakers advertised at $25.00 or less. That's a strong statement if you bear in mind the price we ask but we are so sure that this speaker will please you that you can try it for 10 days. If you don't like it at the end of that time, return it and get your money back. Beautifully finished fibre horn, bell diameter 10 inches. Height 21 in. Handsome heavy base prevents tipping. Connecting cord included.

STANDARD BRAND LOUD SPEAKERS AND UNITS

G618 Brandes Table Talker.....$7.95
G616 Atlas Loudspeaker 22.50
G620 Baldwin Loud Speaker.....22.50
G604 Baldwin Junior Loudspeaker..14.95
G603 Magnavox M4 Loudspeaker....21.00
G612 Magnavox R3 Loudspeaker....29.50
G614 Magnavox M1 Loudspeaker....26.50
G757 Morrison Adjustable Unit..... 4.45
G755 Genuine Baldwin Type C unit 4.75
G608 Atlas Unit. Each.....10.75

LOUD SPEAKER UNITS WITH PHONOGRAPH ATTACHMENTS

Make a loud speaker of your phonograph. These attachments consist of a high grade speaker unit arranged to attach to tone arm of phonograph in place of a reproducer. Fit Victor, Sonora, Silvertone and other phonographs having same size tone arm.
G602 Baldwin $8.80
G607 Western Electric 9.95

PHONOGRAPH ADAPTERS

G771 Fits single unit to tone arm. Each 39c
G773 Fits any double headset to tone arm. Each...65c
Convert your phonograph into a loud speaker. Take off the reproducer and replace with adapter and unit or headset. Such a combination will equal or surpass in tone and volume many high priced speakers.

SUPERIOR RADIO PLUGS

Both styles take two sets of cord tips. Polished round barrels.
G397 With turned fibre barrel. Highest grade obtainable. Each.....44c
G395 With black moulded composition barrel. Wonderful value. Each.....25c

NEW STYLE PLUG

G401 Each 59c
Cords are held firmly in place but can be detached instantly without taking plug apart. No screws to loosen. Bakelite body. Fits all standard jacks. Best plug made.

EXTENSION CORD

G403 30 ft. $1.95
Place loud speaker wherever desired without moving set. Consists of high grade receiver cord of length specified with plug on one end and jack on other to take plug on loud speaker cord.

PHONE CUSHIONS

G774 Pair 43c
Made of soft sponge rubber. Light as a feather. Fit any phones. Exclude all noises and make wearing phones a pleasure.

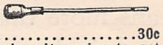
HYDROMETER

G190 Each 48c
Helps keep battery in better shape by showing exact condition.

RADIO SCREW DRIVER

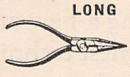
G945 Each 10c
Small screwdriver especially suitable for radio work. Length 4¼ inches. Insulated handle.

LONG BLADE SCREWDRIVERS



G947 6 inch ...20c
G948 8 inch ...25c
G949 10 inch 30c
Long narrow blade makes it easier to get in difficult places. Wood handle. Length given is over all.

LONG NOSE PLIERS



G970 Each 83c
The handiest pliers for radio work. Made of fine hardened steel. Length 5".

DIAGONAL JAW NIPPERS

G972 Each 75c
For fine electrical work, made of hardened steel. Cuts wire clean in tight places. Length 5 inches.

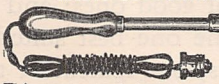
HEXAGON NUT WRENCHES

G950 Set of 3...60c
Handiest tool made for tightening hexagon nuts. Fit nuts for 4/36, 6/32, and 8/32 screws, the three most popular radio sizes.

RADIO SOLDER SET

G538 Complete ...83c
Handy for soldering radio connections or for general small repair jobs. Consists of soldering copper with handle, sal ammoniac, soldering salts, solder and sand paper.

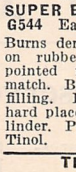
RADIO SOLDERING IRON



G540 98c
This guaranteed iron is exactly right for radio work. A neat solid connection quickly and easily made. Operates on any lighting current 100 to 120 volts. 6 ft. cord with attaching plug. Length 13 inches.

Heavier irons for general repair work. Wonderful values at our prices.
G541 Medium size $2.95
G542 Large size 3.95

AUTOMATIC BLOW TORCH



G543 Each $1.19
Burns denatured alcohol. Automatically generates pointed flame in a few seconds. Easy to solder joints in hard places. Lights with a match. Burns 20 minutes on one filling. 5½ inches high, ⅞ inch diameter cylinder. Works fine with Tinol listed below.

SUPER BLOW TORCH

G544 Each 39c
Burns denatured alcohol. Blowing on rubber tube produces a hot pointed flame. Lights with a match. Burns 10 minutes on one filling. Easy to solder joints in hard places 3 in. high. ⅞ in. cylinder. Produces fine joints with Tinol.

TINOL

G969 Per tube ..19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrically and mechanically perfect joint.

ROSIN CORE SOLDER

G973 4 ounces 28c

ANTENNA MAST FITTINGS

G952 For ½ inch pipe. Per set $1.00
G953 For 1 inch pipe. Per set 2.50
Set includes adjustable base to fit roof peak or flat surface, center guy wire fastening ring and top cap with pulley for rope to raise and lower antenna. No pipe included. Makes the installation of a first class antenna simple and inexpensive.

ANTENNA OUTFIT

G272 Each $2.70
Consists of 150 feet stranded copper antenna cable, lightning arrester, four wall insulators, two antenna insulators, antenna lead-in, 25 feet insulated ground wire, ground clamp and 25 feet connecting wire.

STRANDED ANTENNA WIRE

Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials.
G248 100 ft. coil 48c G249 500 ft. coil $2.30

SOLID BARE COPPER WIRE

Solid bare copper wire for aerials, leads or wiring instruments. Size 14.
G240 100 ft coil 42c G242 500 ft. coil $2.05

GROUND CLAMP

G273 Made of soft copper ⅝" wide with Fahnestock connector. Fits any pipe ⅜ to 1 inch wide. Each 8c

ANTENNA INSULATORS

G263 Ribbed Porcelain insulator, 2½ in. long. Ea. 6c
Dozen 55c
G265 Ribbed Porcelain insulator—5 inches long. Each 15c

ANTENNA LEAD-IN

G259 .....17c
Antenna wire is brought in without drilling a hole. Place on window sill and window can be closed down tight and locked as before. Well insulated. Can be bent into any shape. Made of copper strip properly insulated.

LEAD-IN INSULATORS

G270 For 4" walls or less 42c
G271 For 9" walls or less 69c
The most practical lead-in insulator for aerial wires. Small, neat, effective, durable. Fits ⅝ inch hole. Securely locked by two adjustable nuts.

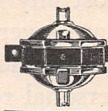
WALL MOUNTING INSULATOR

G262 Each.....7c
Dozen 65c
Galvanized screw mounting. Lead-in wire passes through center of porcelain insulator and is kept away from possible grounds. Easily installed.

PORCELAIN BASE SWITCHES

Fine white porcelain bases. Copper contacts and blades. Can be used as antenna switches.
G385 Single Pole Single Throw. Ea...20c
G383 Single Pole Double Throw. Ea. 32c
G384 Double Pole Double Throw. Ea...50c

OUTDOOR ARRESTER



G980 .....$1.24
Protect your instruments with this lightning arrester. Weatherproof Bakelite case. Underwriters approved.

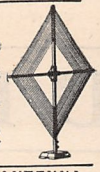
JEWELL LIGHTNING ARRESTER

G981 Each.....85c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

SUPERIOR LIGHTNING ARRESTER

G982 Each.....39c
Porcelain block with brass binding posts. Dependable and effective.

COLLAPSIBLE LOOP ANTENNA



G976 Each.....$3.80
A full size loop antenna 31 in. high 28 in. wide into compact case 18 in. long, 3 in. diam. Well made. Fine looking. Insulated wire, extra flexible. Suitable for use with any loop set. Case included. Quickly set up or taken down.

LIGHT SOCKET ANTENNA

G978 Each.....97c
Screws into any light socket. Replaces the regular out door antenna. Very satisfactory for nearby stations and under favorable conditions will bring in distant stations. Easy to install. No danger. Gives clear reception with little static interference. Ideal for people in apartment buildings.

MULTIPLE PLUG

G402 Each 89c
Attach any number of headsets up to four. Cords attached or detached instantly without taking plug apart.

THE BARAWIK CO. | Chicago's Original Radio Supply House. Beware of Imitators | 102 South Canal St., Chicago, Ill.

Touching the high spots of life

THERE is a wonderland of sport and adventure for either the expert or the new user in a radio instrument that is both foolproof and capable of fine work.

You sit in your own library—you reach out into space with a simple turn of the dials and soon you have contact with—Boston or Schenectady or Pittsburgh, or perhaps some more distant point.

The thrill you get is a real one—it means another stage of amplification of man's contact with man. It means more than that to *you*; it means that you are bringing more and more of the world about that important centre—yourself. It means again that you are learning a new art—an art that you can carry into the finest technique if you are technically inclined, or that you can gradually improve on by merely the practice which repeated operation will give you.

Your pleasure increases with your skill

As you learn the habits of your instrument, you learn how to get satisfying results *every time* you try. You acquire skill in spite of yourself.

Almost any radio set can be made to work. There are several makes of good ones; and the one you should have is the one best suited to your personal requirements; but remember that for general excellence, surety and smoothness of results the De Forest D-12 stands pre-eminent.

The invention of the Audion tube by Dr. De Forest made the present high development of radio apparatus possible. De Forest is the great name in radio. The De Forest Company has been the pioneer in simplifying the outfitting and use of radio. Our D-12 is a complete self-contained unit, with batteries, loud speaker, wires, tubes and antenna all ready for use the minute the battery wires are connected and the loop placed in position on top of the cabinet.

Without either outside antenna or ground wire it does its perfect work. With outside antenna and ground wire it may extend its range somewhat in special circumstances.

Its four tubes do the work of seven

It is built for convenience, and for exactness and economy of operation. Its four tubes do the work of seven, and do it better. It is easy on batteries, and above all, De Forest has won an outstanding reputation in the industry by years of notable performance. It is an instrument you will be proud to own and tell others that you own.

Every great industry has its great standardized product, known by the public for its efficiency, its reliability, and its honestly earned reputation. In the automobile field, the talking machine field, the piano field, there are such. You probably can name them. In the radio field its name is *De Forest.*

Economical to use

It is not a "cheap" instrument, because such standardized performance as the De Forest D-12 will give you is not a cheap thing, and the instrument is worthy of the attractive housing which it has; but it is most economical to use, because

DE FOREST D-12 RE-

Your receiver deserves De Forest Tubes

YOUR radio set is no better than its tubes—for volume and beauty of tone reproduction you must rely on them.

De Forest tubes satisfy the requirements of the most exacting set owner. They are the latest developments in the manufacture of tubes begun many years ago, when Dr. Lee De Forest invented the three-electrode vacuum tube which makes present-day radio possible.

For volume and beauty of tone De Forest tubes are unsurpassed. They are non-microphonic—do not ring or sing or howl. They use little current, and last long.

For dry batteries use the De Forest DV-3. This tube is specially adapted for use on camping trips, and for general use in locations where there is no electric power.

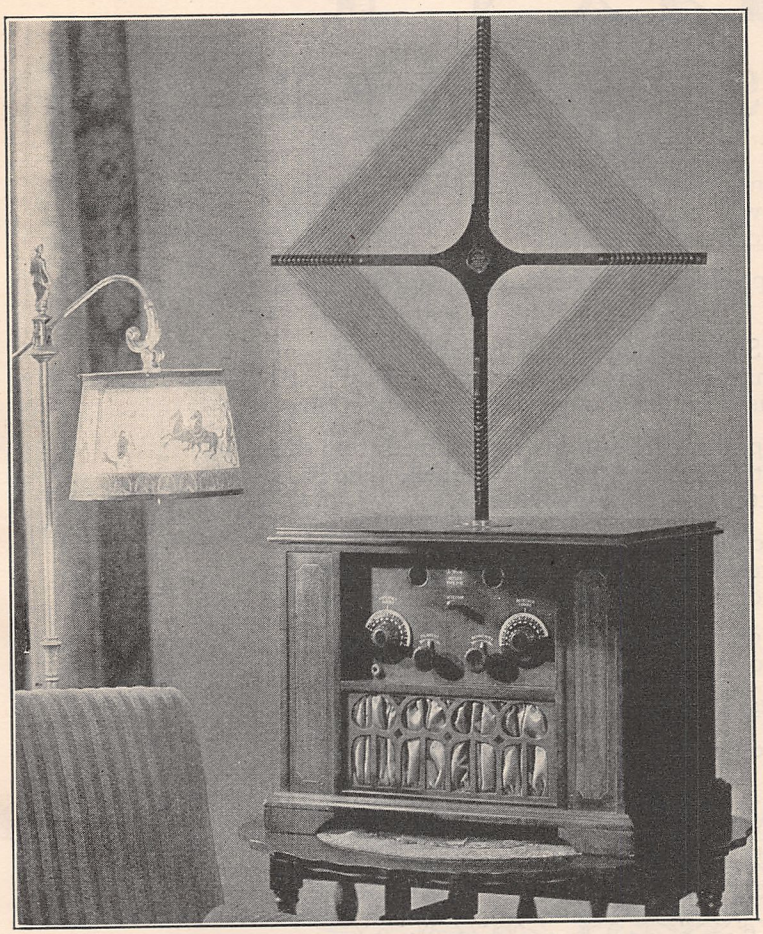
For storage batteries make sure you have the DV-2. With these tubes you can operate practically every circuit in use today.

The name De Forest on these tubes is a guarantee against defects in material, character and workmanship. All De Forest tubes are inspected thoroughly during and after production and are tested. They are packed in individual cartons containing instructions for proper operation and connection. Sold only by authorized De Forest agents. Look for the name De Forest on each tube.

once adjusted it works most satisfactorily, and takes the minimum of current for operation. Though it is not "cheap," it is very low-priced in comparison with any other radio set that will give equal or approximately equal results.

This radio industry is beyond its "pin feather" or elementary experimental stage. The radio receiver was really invented when Dr. De Forest invented the Audion tube—although the world didn't know it for several years.

Good receiving sets today are standardized. You will no more throw away your radio after a year or so than you will throw away your good piano. The De Forest Radio is here, and here to stay.



There is much splendid broadcasting being done today—and it will be better tomorrow—but the so-called "latest word" in receiving sets does not differ in essential principles from that of several years ago—just as the automobile of today's purchase is in essentials the same as the car of the same name was several years ago. Don't be fooled on this. The De Forest Radiophone you buy now will be essentially up-to-date for years.

It is as simple as eating to use the De Forest D-12

You learn how to catch the good things as you follow the broadcasting programs; that is fun. You learn how to get the reproduction clear and strong; that is fun. You learn the delicate art of picking up distant stations, and that is heaps of fun. You learn what radio *won't* do in the summer and what it will do in the winter. You learn its whims and whimsies. You learn it is as interesting as a beautiful girl; as temperamental as an artist, and you learn to be a master of its whims and temperaments.

You may do this with or without learning its mechanical and scientific principles. Suit yourself. It is fun either way.

Here are directions for using De Forest D-12:

Have your dealer deliver the instrument to you—put the loop into its place, turn the dials till you get your station (your dealer will show you how) and then your fun begins. Listen and change your stations to your heart's desire.

DE FOREST
RADIO TEL. & TEL. CO.
Jersey City, N. J.

FLEX RADIOPHONE

De Forest D-12 Reflex Radiophone

A four-tube, long distance indoor loop receiver, with self-contained batteries and loud speaker

1. COMPACTNESS—Completely self-contained in beautifully designed case with two foot antenna. No bothersome aerial and ground wires, or outside batteries or loud speaker.

2. SIMPLICITY—Controls simple enough for the veriest amateur, critical enough for the expert. Calibrated tuning chart with each set. Raising the cover makes all parts accessible.

3. EFFICIENCY—Six stages of amplification and one stage detector gives high selectivity on this four tube circuit. Tuned radio. Volume controllable from faint whisper to the crashing of a brass band, with perfect fidelity of tonal quality. Great distance range.

4. ECONOMY—This four tube reflex circuit cuts cost of tube replacement and battery upkeep. If more than five tubes are used the "B" batteries are used up at ruinous rate.

5. MOBILITY—The D-12 is so light and compact you can easily move it from room to room and is so well built that this will not put it out of commission. Can easily be carried in the tonneau of your car. Some users install it on a tea-wagon. The leather covered set will not mar easily.

6. BEAUTY—This is the smartest and handsomest moderate priced set, in either its embossed two-toned leather or its piano finished two-toned mahogany case.

7. Remarkably low price. The De Forest D-12 Reflex Radiophone is several hundred dollars below any other set that compares with it in distance range, efficiency or beauty.

ATWATER KENT

LOUD SPEAKERS

THE smooth, mellow tones of an ATWATER KENT Loud Speaker will please you—you will be delighted with the fidelity with which it reproduces broadcasts.

It is a faithful sound reproducer, and re-creates the full overtones of voice and violin.

ATWATER KENT Loud Speakers have an adjustable diaphragm operated by a powerful magnet which has been thoroughly aged. The diaphragm is slightly dished and is clamped between rubber rings.

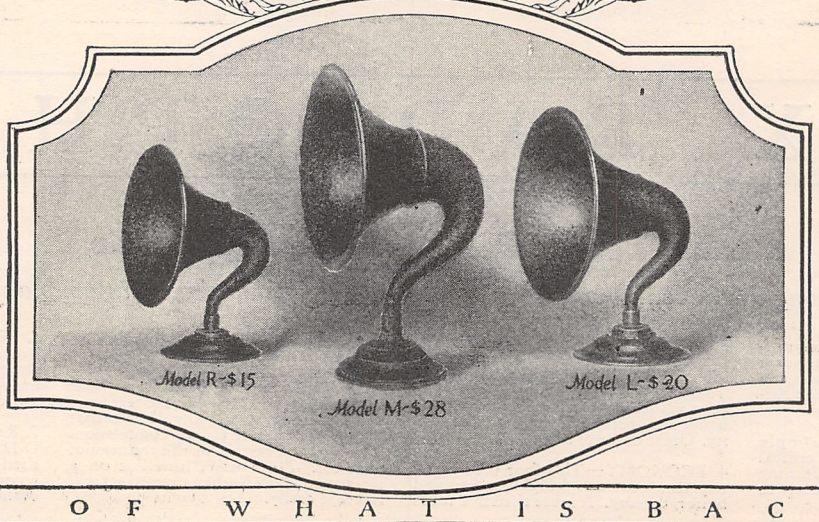
ATWATER KENT Loud Speakers are sturdily constructed from the fine operating mechanism to the heavy pressed steel bell. The base is substantial and is protected with a heavy felt disc.

The design and construction of the ATWATER KENT Loud Speaker is the result of painstaking research; of almost endless tests and experiments:—it sets a new standard in the production of loud speakers.

Everyone can now enjoy an ATWATER KENT Loud Speaker:—there are sizes and prices to meet every buyer's preference.

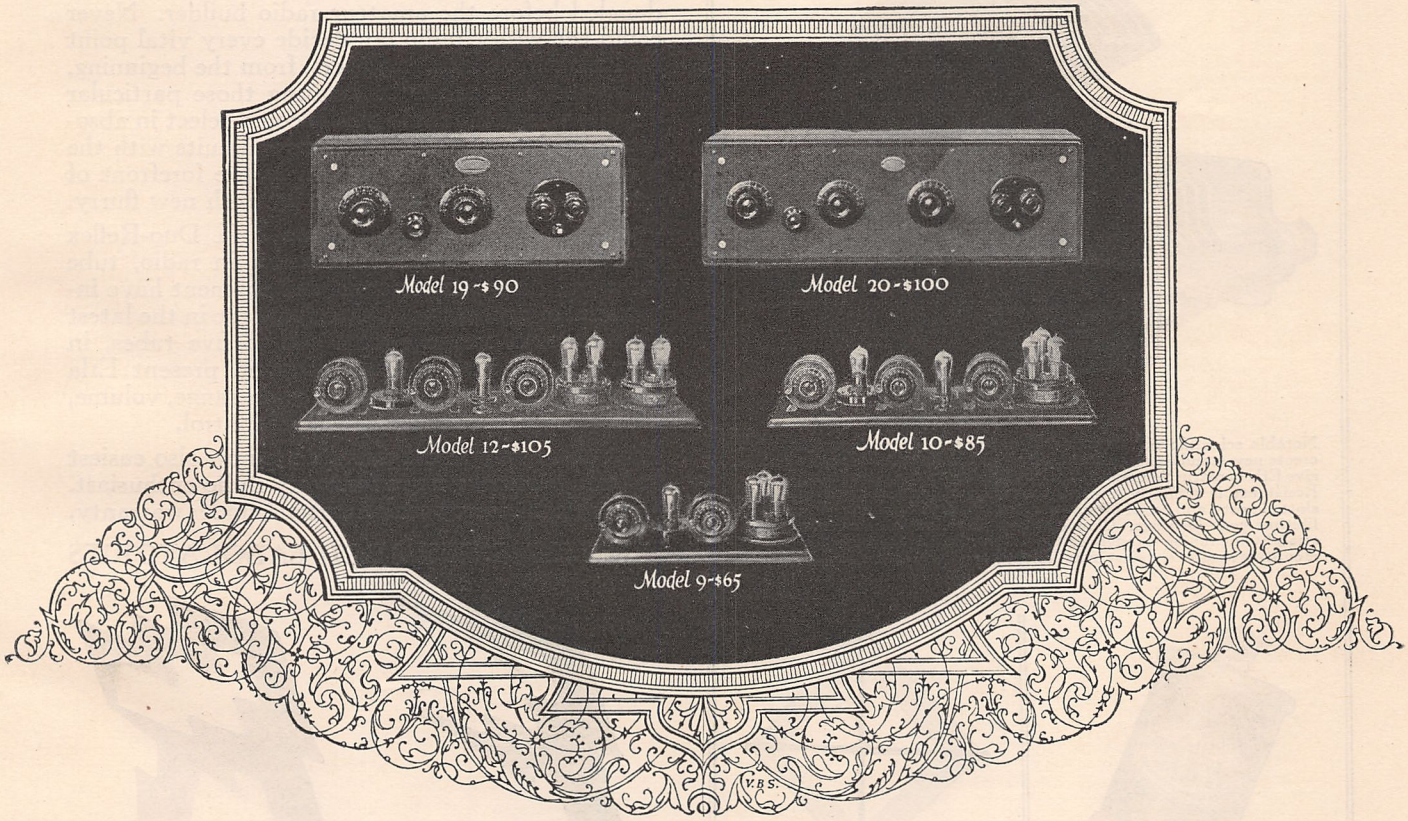
Descriptive literature on request

ATWATER KENT MANUFACTURING COMPANY, *4943 Stenton Ave.*, PHILADELPHIA, PA.



ATWATER KENT

RECEIVING SETS



ATWATER KENT Receiving Sets meet the demands of the buyer who wants definite and uniformly dependable results; distance,—minimum of interference,—volume and clear reception.

The radio experimenter, tinkering with a thousand "hook-ups," finds fascination, but might experiment a life-time without achieving ATWATER KENT results.

No material can be better than is found in ATWATER KENT Radio—no workmanship is finer and it is the last word in Radio designing.

You must examine ATWATER KENT Radio to fully appreciate its value:—It is an outstanding example of quality produced on principles adhered to in the manufacture of scientific electrical instruments for more than a quarter of a century—

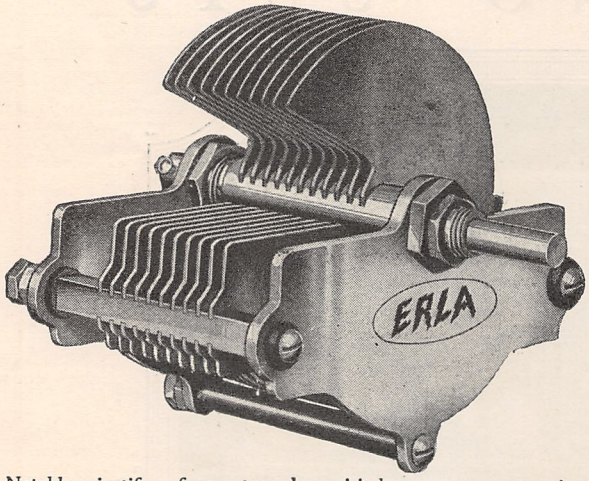
You can select any ATWATER KENT Radio Equipment—receiving sets or loud speakers and look forward to freedom from doubt as to the wisdom of your choice.

Instructive literature on request

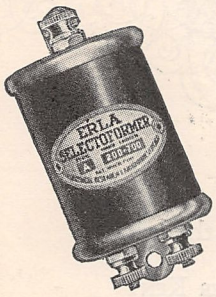
ATWATER KENT MANUFACTURING COMPANY - *4943 Stenton Avenue* - PHILADELPHIA, PA.

Erla Solderless Connectors make child's play of receiver construction, eliminating difficult soldering entirely.

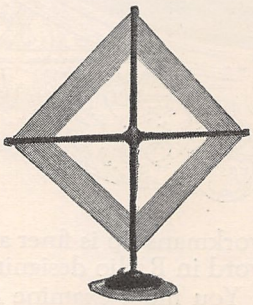
Build Most Efficient Circuits



Notable scientific refinements and exquisitely accurate construction create new standards of efficiency in Erla Miniloss Condensers. Exclusive Erla construction reduces dielectric losses to the lowest ever known. Resistance is similarly lowered through positive locking of plates in slotted posts, and use of grounded rotor, fitted with adjustable, oversize lifetime cone bearings. Compensating plate form provides improved straight line tuning throughout the entire wavelength range. Single-hole mounting assures simplest installation, 5 to 41 plate types, $3.50 to $5.50.



Increased selectivity, simplified construction, and greater ease of control are contributions to reflex work made possible only by Erla Selectoformer. Price $5 ea.



Folded—most compact in radio. Erected—most rigid. Yet free in rotation. Peak efficiency joins finest appearance in Erla Loops. Standard $7.50—Deluxe $10.

Fixed condenser accuracy is the very basis of success in radio. One fixed condenser only—Erla—is guaranteed within 1% of rated capacity. 11 sizes, 35c to 75c.

Laboratory adjustment to predetermined correct rectification value places Erla Fixed Crystal Rectifiers beyond comparison for clear reception and stability. $1.

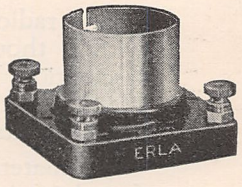
A thousand and one circuits and theories have been dangled before the amateur radio builder. Never could the wisest radio fan decide every vital point for himself. So Erla engineers, from the beginning, dedicated themselves to creating those particular circuits which the radio public could select in absolute confidence as the last word—circuits with the inherent superiority to remain in the forefront of radio advancement, unshaken by each new flurry.

From this fixed purpose came Erla Duo-Reflex Circuits, rated the most powerful in radio, tube for tube. Now research and development have intensified every original Erla advantage in the latest Erla circuits, ranging from one to five tubes, in loop and antenna models. Beyond present Erla perfection it is not possible to go in range, volume, tonal purity, selectivity or ease of control.

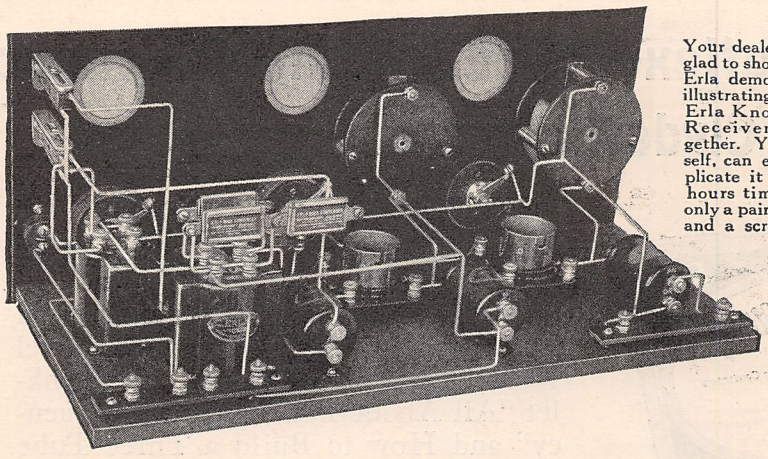
That these very finest circuits are now also easiest to build is stirring news for every radio enthusiast. Available in factory-sealed cartons, under warranty,

ELECTRICAL RESEARCH LABORATORIES

The matchless purity and volume of Erla circuits are aided indispensably by Erla Audio Transformers, supreme in distortionless 3-stage amplification. $5.00



Wiping contact of tilted double cushion springs, the unbreakable metal bayonet slot, and reinforced Bakelite base, give Erla Sockets preference. Prices 65c — 75c.



Your dealer will be glad to show you an Erla demonstrator, illustrating just how Erla Knockdown Receivers go together. You, yourself, can easily duplicate it in a few hours time, using only a pair of pliers and a screwdriver.

By Methods Most Advanced

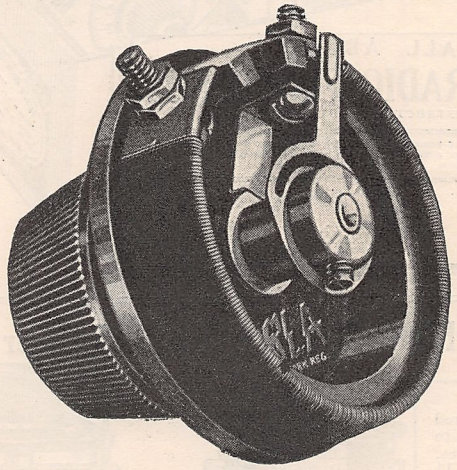
are the complete Erla Knockdown Receivers, ready for correct assembly, in truly professional manner, by anyone who has handled pliers and screwdriver, the only tools required.

Erla scientific precision apparatus, vital to matchless Erla results, is furnished complete, including synchronizing radio and audio transformers, balanced crystals, tested capacity condensers, and every needed part down to wire, terminals, screws and Erla solderless connectors, which banish the soldering bugaboo.

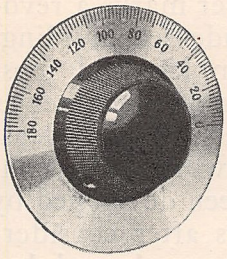
To assure quick, flawless assembly, the panel is drilled and lettered, while the baseboard is stenciled, correctly locating every unit and connection.

You yourself, therefore, can construct the most advanced radio circuits, by the most efficient and most economical method, confident that your receiver, sponsored by Erla, is unsurpassed. Ask your dealer about Erla Knockdown Receivers, or, if writing direct to us, give dealer's name.

Department C, 2500 Cottage Grove Avenue, CHICAGO

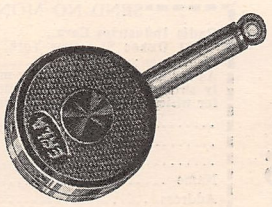


The silky "feel" of Erla Precision Rheostats and Potentiometers is one of many indications of marked advancement. The factory-adjusted tension of the special spring arm is undisturbed by installation, because the novel single-hole mounting eliminates disassembling. Genuine Bakelite is used throughout, with special oversize alloy wire of excess radiating and carrying capacity. The minute, sensitive control, free from adjustment noises, is a notable characteristic. Rheostats, 6-, 25- and 40-ohm, $1.10. Potentiometers, 200-ohm, $1.25. 400-ohm, $1.40.



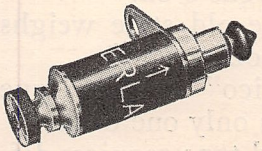
In frosted silver or gold, with Bakelite knob proportioned for utmost delicacy of touch. Erla Dials improve any receiver. 2", 3", 4" dia. ¼" shaft. Prices 50c to $1.25

Utmost amplifying power, with extreme selectivity and complete absence of distortion, are made certain in reflex work through Erla Synchronizing Transformers. $5.

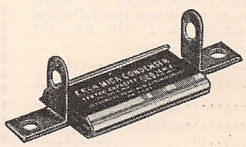


Instant, positive grip of phone tips without aid of tools is provided through exclusive construction of Erla Autogrip 2-Way Phone Plugs, decidedly better. 75c.

Erla Push-Pull Transformer is exclusive in core design and shielding. Indispensable for safe operation of high resistance loud speakers under full power. $10 pr.



Minute individual variations in receiver characteristics are most accurately compensated for with Erla Semi-Fixed Crystal Rectifiers, assuring best reception. $1.



Erla Fixed Condensers of certified accuracy—warranted within 1%—are now available with ingenious spring mounting for tubular grid leaks. .00025 mfd—35c.

Nationally Advertised

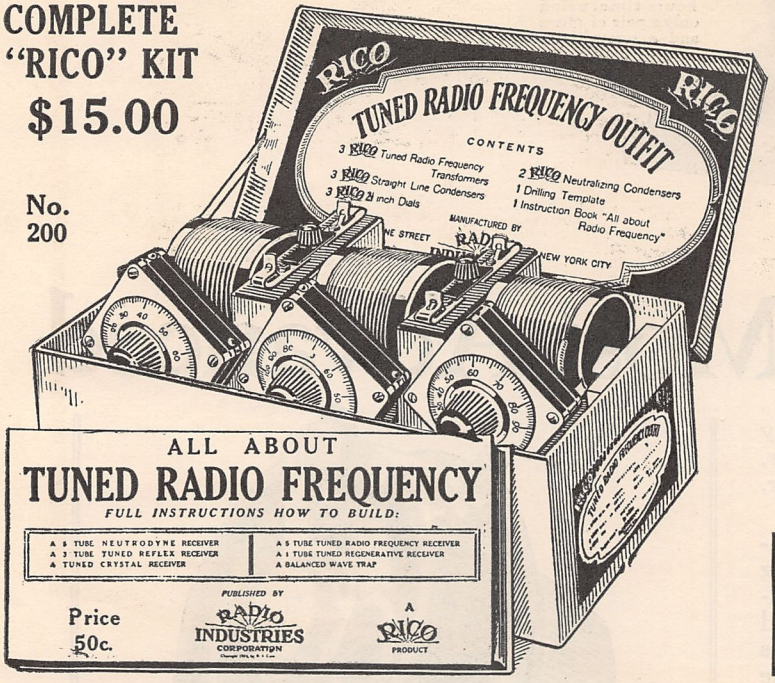
RICO

The Mark of Guaranteed Products

3 Tube Reflex—Tuned Radio Frequency Build Clyde Fitch's Latest Hookup

COMPLETE "RICO" KIT $15.00

No. 200



Complete "RICO" Kit

Contains 3 "RICO" Radio Frequency Transformers, coupled with the "RICO" Straight Line Condensers and Dials and two "RICO" new model Neutralizing Condensers. The booklet "All About Tuned Radio Frequency" and How to Build a Three Tube Reflex Set, is complete in all details, without the use of technical language. Two drilling templates make it impossible to go wrong in laying out the panels.

This is the greatest value ever offered for a high grade product.

FREE Eight page booklet, "ALL ABOUT TUNED RADIO FREQUENCY," giving full instructions how to build a *Three Tube Reflex* outfit that accomplishes everything a five tube Neutrodyne outfit does. A postal-card will bring it.

The "RICO" Straight Line Condenser

Now manufactured in three types, to replace 43 plates, 23 plates and 11 plates.

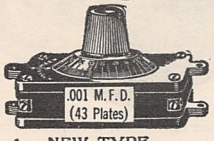
No. 450 "Rico" Condenser .001 mfd. (43 plate capacity) **$1.75**

No. 423 "Rico" Condenser .0005 mfd. (23 plate capacity) **$1.75**

No. 411 "Rico" Condenser .00025 mfd. (11 plate capacity) **$1.75**

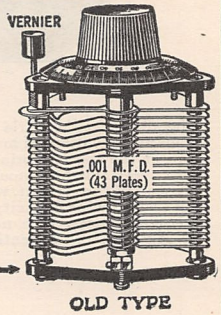
All above types without dial **$1.50**

THREE STYLES
.001 mfd. (43 Pl.)
.0005 mfd. (23 Pl.)
.00025 mfd. (11 Pl.)



NEW TYPE

This Replaces This



OLD TYPE

This condenser marks a revolution in condenser building. It is the simplest and most practical type of condenser as yet developed for broadcast and amateur work. This condenser has been developed by our engineers after considerable research work and has been pronounced perfect by experts.

The "Rico" condenser weighs 6 oz.

The old style weighs 15 oz.

"Rico" vernier type has only one dial.

Old type requires difficult mechanism.

COUPON

Radio Industries Corp., RN-11
131 Duane St., New York, N. Y.

Gentlemen:
As my dealer cannot supply my needs, kindly ship to me direct the following material, for which I will pay the postman on arrival.

.....
.....
.....

Name .....
Address .....
City .....
My dealer's name is.....

SPECIAL ANNOUNCEMENT

(NEW PRICE)

"RICO" No. 6 Headset

GUARANTEED FOR ONE YEAR

FAMOUS TRI-POLE PULL

PRICE $2.95

Finest pair of Headsets made

DON'T PAY MORE

INSIST ON "RICO"

Our large Production enables us to give you the full benefit of this unusually low price

RADIO INDUSTRIES CORPORATION
131 Duane Street, New York City
Cable Address: Ricotrade, New York

Use coupon if your Dealer cannot furnish

SEND NO MONEY

Radio Industries Corp., RN-11
131 Duane St., New York, N. Y.

Gentlemen:
As my dealer cannot supply my needs, kindly ship to me direct the following articles, for which I will pay the postman on arrival.

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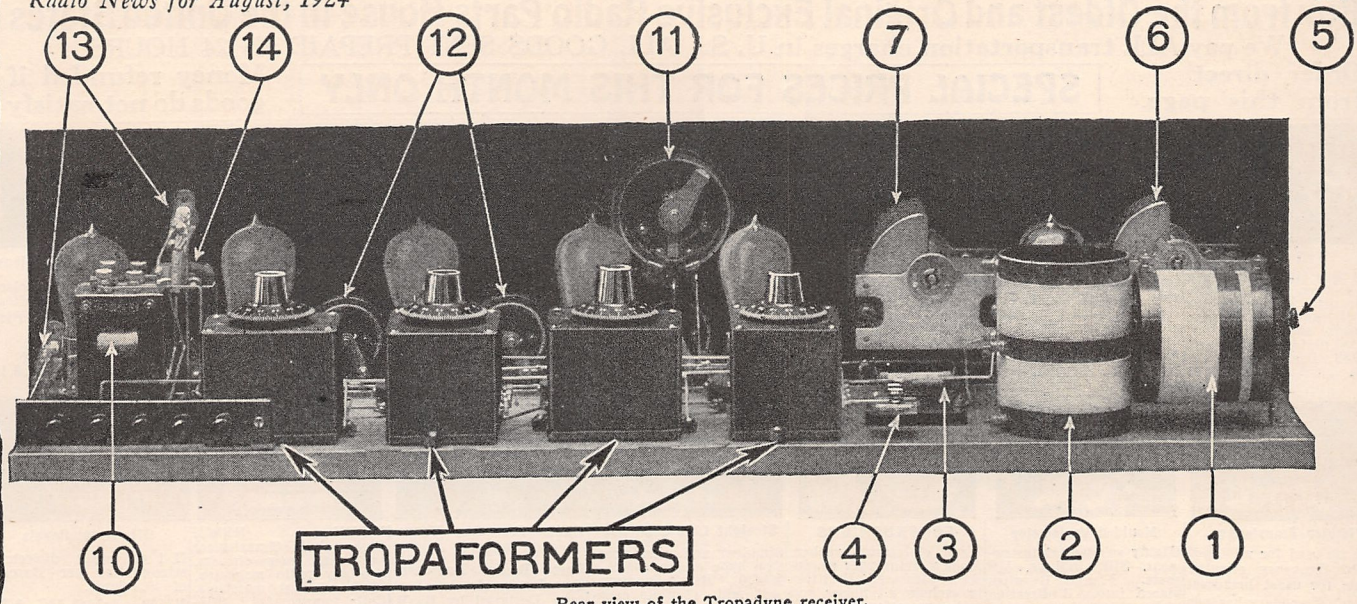
.....
.....

Name .....
Address .....
City .....
My dealer's name is .....

Do Not Fail to Read the "RICO" Advertisement on the Next Page



Rear view of the Tropadyne receiver.

The spacing of the R. F. transformer coils can be clearly seen. The numbers designate the following instruments: 1, the tuner; 2, the oscillator coil; 3, the grid leak; 4 and 5, fixed .0005 condensers; 6, the tuning condenser; 7, oscillator condenser; 8, loop jack; 9, tuned R. F. transformers; 10, A. F. transformer; 11, potentiometer; 12, rheostats; 13, jacks for detector and loud speaker.

the Tropadyne circuit one tube acts both as oscillator and detector, and is a frequency changer. This is where this circuit gets its name; *tropaia* from the Greek, meaning change, and *dyne* meaning force.

Fig. 1 shows the Tropadyne circuit. Only one tube is shown, which is merely a frequency changer when used in a Super-Heterodyne receiver, and may be used with any type of Super-Heterodyne now ... As shown in the diag... both loop ...

The electrical center of the oscillator circuit is approximately at the center turn of the coil. In practice, this connection is not critical. It may be two or three turns either side of the center, without seriously dec... ing the efficiency.

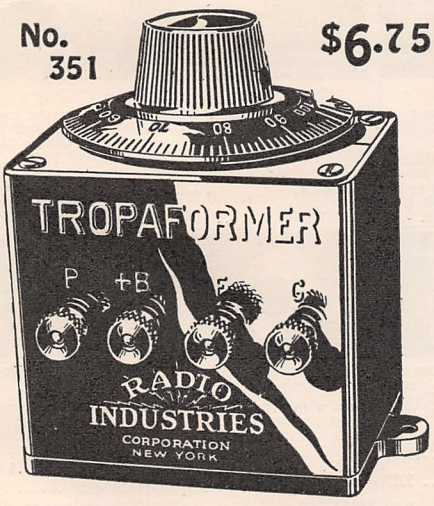
Although ... flowi...

be tuned independently to the same or different wave-lengths. This is a condition ... has never before been attained ... tube ...

THE TROPADYNE

Better than the Super-Heterodyne. Radio's Latest Achievement

(Reprinted from August Radio News)



(Patents Pending)

The TROPAFORMER here illustrated is the only scientific balanced intermediate Super-Heterodyne transformer. It combines transformer and condenser, and enables the transformer to be tuned to the very finest degree. Once tuned it need not be touched again. Built entirely of hard rubber.

The Tropaformer does away with special input couplers, inaccurate, fixed by-pass condensers and inefficient, broadly tuned transformers. It may be tuned to any wave-length from 250 to 10,000 meters, thus the advantages of either low or high intermediate frequency can be had.

In the August, 1924, issue the Editor of RADIO NEWS has this to say about the TROPADYNE circuit:

> "Here is a remarkable Super-Heterodyne receiver which we warmly recommend to our readers. It has several new and unusual features. In the first place only six tubes are used giving as much volume as the average 8 tube Super-Heterodyne. The selectivity of this set is unusual. Unequalities of the intermediate transformers have now been done away with by tuning each transformer. After the transformer has been tuned it can be left this way, no further tuning being necessary. This system makes for maximum sharpness and maximum volume. Another outstanding point of superiority of the Tropadyne circuit is that it practically does not radiate, thereby not interfering with other nearby receiving stations. Most Super-Heterodyne circuits, as is well known, are powerful radiators."

It is now possible to build a real Super-Heterodyne that not only exceeds them all, but is the only Super-Heterodyne *scientifically balanced*. Heretofore when building a Super-Heterodyne you either made or bought the intermediate transformers. These *never* matched as it is impossible to make two windings exactly electrically alike.

While some firms are advertising matched or balanced transformers this is a misleading statement because even though they are balanced ever so well, when placing them in the circuit they become unbalanced automatically due to inductive effects between transformers, lead wires, etc.

The TROPAFORMERS built according to the inventor's—Mr. C. Fitch—specifications can be scientifically balanced by anyone. Each transformer is equipped with one of our well known condensers which is shunted across the secondary of the transformer. This is the big secret of the TROPADYNE circuit and accounts for its wonderful work. Once the TROPAFORMERS are tuned by means of the shunt condensers they need not be touched again; *the balancing is permanent.*

Any other technical information will be gladly supplied by us. We offer to the trade and those interested in building their own TROPADYNE Super-Heterodyne the following:

No. 350 Kit containing four TROPAFORMERS with shunt condensers, tuner, shown under (1) in the above illustration, and one oscillator coil, shown under (2). Price complete with booklet giving full directions.....	**$28.75**
No. 351 Tropaformer, each	**6.75**
No. 352 Tropadyne Bakelite Tuner, each	**1.25**
No. 353 Tropadyne Bakelite Oscillator coil, each	**1.50**

Use coupon if your Dealer cannot furnish

SEND NO MONEY

Radio Industries Corp., RN-11
131 Duane St., New York, N. Y.

Gentlemen:

As my dealer cannot supply my needs, kindly ship to me direct the following articles, for which I will pay the postman on arrival.

.....

.....

.....

Name .....

Address .....

City .....

My dealer's name is .....

Do Not Fail to Read the "RICO" Advertisement on Opposite Page

"BUILD YOUR OWN" WITH "RASCO" PARTS!

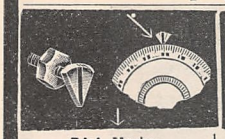
Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

SPECIAL PRICES FOR THIS MONTH ONLY

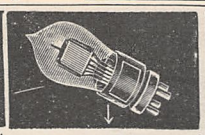
Money refunded if goods do not satisfy



Dial Marker

The big little thing you have been waiting for. Just drill a hole in the panel and mount the marker above the dial. Nickel plated and polished.

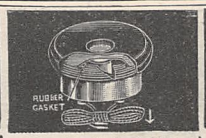
N7788 Dial Marker, each .....$.05



Vacuum Tubes

Only best make tubes carried in stock. Any tube replaced if defective, providing filament lights.

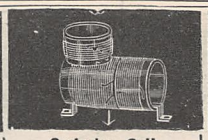
N201A 5 v., .25 amp. $2.50
N199 3 v., .06 amp. 2.50
N12 1½ v., .25 amp. 2.50



"Rico" (Adjustable) Loud-Speaker Phone

Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.

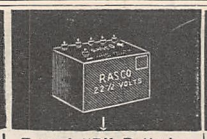
N2525 Speaker with 5 ft. cord $2.65



Cockaday Coil

Guaranteed best make. Three windings of No. 18 Magnet wire. Has brass brackets for panel or base mounting. Satisfaction guaranteed or money back.

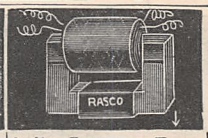
N2750 Cockaday coil $1.50



Tapped "B" Batteries

We positively guarantee these batteries to be of long life. We carry only fresh stocks. All with taps.

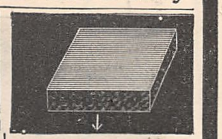
N2250 Sm. 22½ V...$.85
N2251 Medium Navy size, 22½ volt.....1.20
N4500 Large size, 45 volt 2.30



Audio Frequency Transformer

No better Transformer made. Highest class materials. Impregnated coils. Silicon steel stampings used. Save 50 per cent by assembling it yourself.

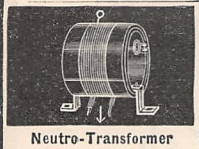
N1100 Ratio 4½-1 $2.00
N1150 Ratio 6½-1 2.00



Sponge-Rubber Cushions

Get rid of tube noises due to vibration. Softest sponge rubber made. Size 2½"x3", ⅜" thick.

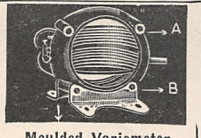
N8989 Sponge-rubber cushions, each .....$.12



Neutro-Transformer

Can be used for all tuned radio frequency circuits. Made for usual broadcast waves. Secondary has one center tap. Two genuine bakelite tubes.

N6909 Neutro-transformer $1.65



Moulded Variometer

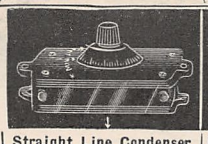
Highly substantial instrument. Silk windings. ¼" shaft. Flange B when placed into AB direction makes instrument panel mounting. 180 to 650 meters. Money back if this instrument is not all that we claim for it.

N5350 Variometer..$3.00

FONEKUSHIONS

Made of sponge rubber. Make wearing your receivers a pleasure. Positively exclude all noises and make reception a pleasure. Sponge rubber will last for years. Light as a feather.

N3550 Fonekushions, set of two .....$.42



Straight Line Condenser

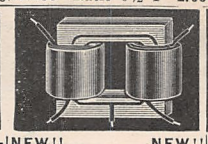
Simplest and most practical type of condenser.

N4430 "Rico" Condenser .001 mfd. 43 plate capacity $1.75
N4230 .0005 mfd. 23 plate capacity $1.75
N4110 .00025 mfd. 11 plate capacity $1.75
All types no dials $1.50

Radio Frequency Transformers

Best Radio Frequency Transformer developed so far. Designed by R. E. Lacault, Associate Editor RADIO NEWS. Air core type. 200-600 meters.

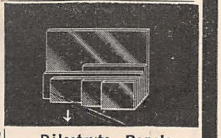
N2800 Transformer, size 1⅞"x2½" $1.50



NEW!! NEW!!

Push Pull Transformer for many new circuits. See any radio magazine. Made of best materials. Coils impregnated. Silicon steel laminations. Save 50 per cent by assembling yourself. Simple instructions furnished.

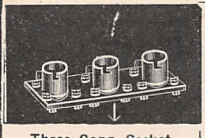
N1159 Transformer, Ratio 6½ to 1....$4.00



Dilectryte Panels

Highest dielectric strength as per Bureau of Standards.

N7100 7x10x3-16"..$.70
N7120 7x12x3-16".. .85
N7140 7x14x3-16".. .95
N7180 7x18x3-16"..1.25
N7210 7x21x3-16"..1.45
N7240 7x24x3-16"..1.65



Three-Gang Socket

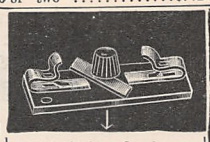
Aluminum shells, genuine heavy bakelite base, 3 brackets for mounting, 12 nickel binding posts. Length 7¼".

N5995 3 gang socket $1.50

Rasco 180° Variocoupler

Silk wire wound on bakelite tubes. Six taps. Wave length, 150 to 600 meters. For panel mounting. ¼" shaft. Your money refunded if it is not all we claim.

N3100 Variocoupler prepaid $1.50

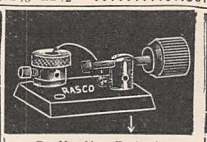


Neutralizing Condenser

Latest pattern. Genuine Bakelite base. Fahnstock connectors, hard rubber composition knob, easiest to regulate. Size 3⅝" long, 1" wide.

N1202 Neutralizing condenser .....$.40

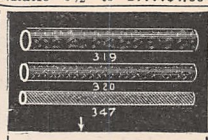
BE SURE TO SEE PAGE 815 OF "RADIO NEWS" FOR NEW "RASCO" GOODS



Radiocite Detector

Base solid black composition. Automatic crystal holder. Triple adjustments. Smallest, neatest detector made. Radiocite crystal. 200,000 in use.

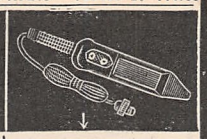
N1899 Detector .....$.60
N1898 Galena detector .....$.50



Spaghetti

Varnished flexible cambric tubing, 319 takes No. 22 wire; 320 takes 18 to 20 wire; 21 takes 16 to 18 wire; 344 takes 22 to 28 wire.

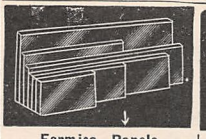
N319-320-321 Per ft. $.06
N344 Flexible soft rubber tubing; 10 feet for..$.20



Soldering Iron

Smallest and handiest made. Fits any flat iron or percolator plug. Plug then becomes handle. 5" long. Complete but without plug or wire.

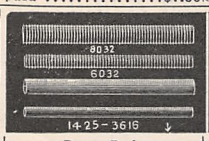
N2200 Soldering iron $1.45



Formica Panels Clearance Sale

As we are discontinuing these particular sizes, this material is now offered at cost. All 3-16" thick.

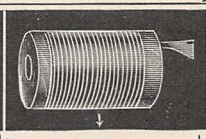
N352 9x12" each....$1.75
N354 6½x19½" ea.. 1.90
N356 6x14" each.... 1.60
N357 6x4" each .... .65



Brass Rods

Sold in 6" lengths only.

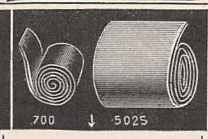
N8032 Rod, 8-32" thread length .....$.08
N6032 Rod, 6-32" thread length .....$.06
N1425 Rod, plain ¼" round, length .....$.10
N3616 Rod, plain 3-16" round, length .....$.06



Litz Wire

Prices are per foot. E= equals.

N823 E No. 25 B&S $.02
N890 E No. 28 B&S .01
N891 E No. 21 B&S .03
N892 E No. 20 B&S .04
10 per cent discount in 100 foot lots.



Copper Ribbon

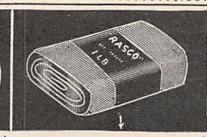
.005" thick.

N700 ⅜" wide; N701 ¼" wide; N702 3-16" wide. All sizes per foot...$.01

Copper Foil

.001" thick. 4" wide.

N5025 Copper Foil, per foot .....$.10
10-foot length ..... .80

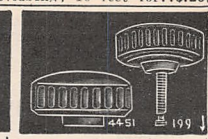


Tin Foil

All our tin foils come 4" wide. Uniform product throughout.

Best grade only N850 has 1500 sq. inches per lb.

N851 700 sq. inches to lb.
N850 Tin foil.....lb. $.48
N851 Tin foil.....lb. .48



Switch Knob

N199 Knob, 1⅛" dia. height 5⅛"; 8-32" screw.

N4451 has 8-32" or 10-32" bushing, no screw.

N199 Knob .....$.10
N4451 Knob ..... .06

"Rasco" Bezels

Finest Bezel on the market. Bezel comes entirely nickel plated. Can be used on ⅛ or 3-16" panel.

N1700 Rasco Bezel, 1 inch .....$.15
N1701 Bezel, 1½" diam. ..... .20

Mounted Crystal-Cup

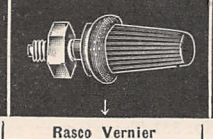
Cup has screw and adjustment nut. Fits all standard mounted crystals. Nickel plated, polished.

N318 Nickel Cup ...$.20

Radiocite

Best most sensitive mounted crystal. U. S. Navy using it. Each tested.

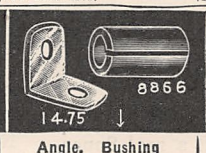
N317 Radiocite Crystal .....$.25



Rasco Vernier

Why use a vernier condenser when a vernier attachment will do anything and everything a vernier condenser accomplishes? Cleverest vernier made. Can be used with any dial. Soft rubber ring engages dial. Nothing to come apart.

N1450 Vernier .....$.18



Angle. Bushing

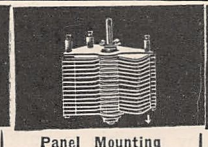
Angle piece used to mount panels, etc. 1,000 uses. 5-16" wide, height 7-16".

N1475 Angle piece. Each .....$.03

Adapter Bushing

Makes ¼" dial fit 3-16" shaft. ⅜" long.

N8866 Bushing .....$.04



Panel Mounting Condensers

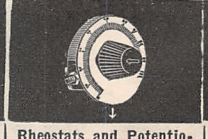
Positively no better condenser on the market. Shafts ¼". Save from 40 to 60 percent by assembling condenser yourself.

N1111 11 plate.....$1.10
N2121 21 plate..... 1.22
N4343 43 plate..... 1.33

Storage Batteries

Guaranteed for two years. Only NEW material used. Acid proof terminals. Patent vents.

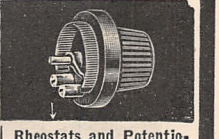
N2400 Two volt, 40 amp. hours $3.90
N640 Six volt, 40 amp. hours 7.25
N666 Six volt, 60 amp. hours 9.50
Shipped express collect.



Rheostats and Potentiometers

Come with metal dials and composition knob. Excellent merchandise despite low price.

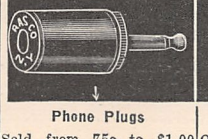
N4210 6 ohm Rheo...$.27
N4211 30 ohm Rheo.. .30
N4212 200 ohm Potentiometer ..... .45



Rheostats and Potentiometers

High heat dielectric base. Come with tapered, knurled knob, 2½" dia. Complete with pointer.

N4310 6 ohm.....$.38
N4311 30 ohm ..... .44
N4312 Potentiometer, 200 ohms ..... .65



Phone Plugs

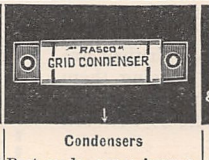
Sold from 75c to $1.00 everywhere. Hard rubber composition shell and patented cord tip holder. Finest workmanship throughout.

N1030 Rasco Telephone Plug. Each .....$.35

Bakelite Socket

Octagon shape. Four nickel binding posts, phosphor bronze contact springs. Best brown bakelite.

N6510 Bakelite socket $.40
N6500 Tube Socket. Made entirely of composition. Best made. Each ....$.35



Condensers

Best made, paper-impregnated condensers. Capacity guaranteed.

N5050 Phone Condenser, .001 .....$.20
N5056 Grid Condenser, .00025 .....$.20
N5059 Grid Leak Condenser, .00025.....$.30

Name Plates

All name plates brass with silver letters.

N8389 (Right or left) $.10
N809 Comes in 35 styles. Any denomination, each style .....$.04
Panel Scale. 2½". 90°. metal, silver background, black lettering.
N715 Scale. Each ...$.15

Binding Post Name Plates

Dia. ¾". These styles: Phones, Ground, —, Output, "A" Bat. —, "B" Bat. —, Loud Speaker, "C" Bat. —, Aerial, +, Input, "A" Bat. +, "B" Bat. +, Loop "C" Bat. +. New! "A" Bat. + "B" Bat. —.

N6000 Name Plates, all styles, each .....$.03

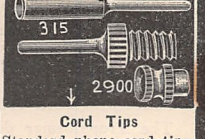
"Rasco" Posts

Made of black composition.

N650-51 Each .....$.08

N202 Has nickel-plated bottom, each .....$.08
Dozen, each style....$.90

N122 Initialed Binding Posts. Six popular styles. Each .....$.06



Cord Tips

Standard phone cord tips, nickeled.

N315 Each.....$.03

Separable Cord Tips

No solder required. Wire goes in ferrule. Shank holds it tight. Nickel plated.

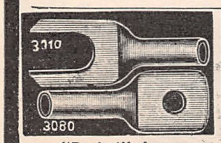
N2900 Each.....$.06

RADIO SPECIALTY COMPANY, 98 Park Place, New York City

Factories: Brooklyn, N, Y. Elkridge, Md.

"BUILD YOUR OWN" WITH "RASCO" PARTS!

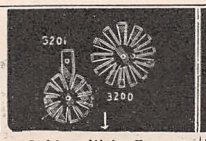
Prices Lower Than Ever



"Perfect" Lugs

These new and improved lugs are brass, nickel plated, flattened on top as shown. Made of a single piece of metal. Lead wire goes into tube.

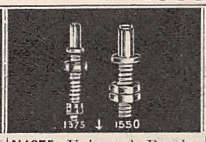
N3110, N3080 "Perfect" Lugs. Each $0.02
Dozen lots ..... .20



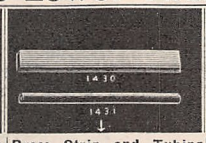
Spider Web Forms

Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. Both 5" diameter.

N3200 Spider form..$.25
N3201 Spider form.. .25



N1375 Universal Bearing to hold rotors. Length of bearing 2¾", shaft 1¼" thread 1" long threaded sleeve ¾" long, each .....$.25
N1550 Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 $.25

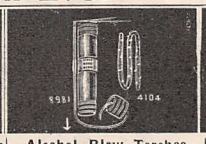


Brass Strip and Tubing

Brass strip ½" wide; 1-16" thick; 6" long.
N1430 Per length...$.10
N1431 Brass tubing, dia. ¼"; 6" long; length $.15

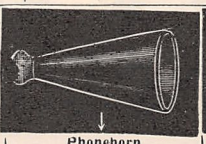
Threaded Brass Rods

Sold in 6" lengths only.
N8032 8-32" thread.$.08
N6032 6-32" thread. .06



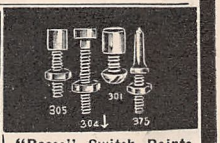
Alcohol Blow Torches

Best made. Give intense hot flame. Great for fine work.
N8981 5" Torch.....$.85
N8982 3" Torch..... .50
N4104 Rosin Core Solder. A non-corrosive solder with flux inside. 18" length .....$.10



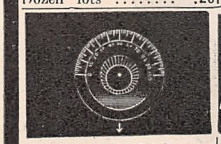
Phonehorn

Base consists of Phonodapter into which fits a fine enameled fibre horn. Size of horn 12"; bell 6½". Slip Phonodapter end on a single telephone receiver.
N1321 Phonehorn, prepaid $1.25



"Rasco" Switch Points

Nickeled and polished.
N301 ¼"x¼", 6-32", doz. .....$.18
N304 ¼" dia., ⅛" thick, 6-32", doz.... .18
N305 ¼" dia. 3-16" thick, 4-36", doz.... .18
N375 Switch stop ⅞" long, with nut, doz... .18

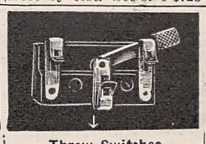


Moulded Dials

Only very best grades handled. Bushings absolutely true. Dials cannot wobble. Letters inlaid in fast white enamel. All dials for ¼" shaft.
N3074 Dial 2" ....$.20
N3075 Dial 3" .... .25
N3076 Dial 4" .... .40

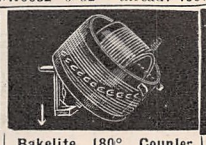
Tuned Radio Freq. Kit

Build your own Neutrodyne or Neutro-Reflex with this kit. Contains 3 R.F. Neutro-Transformers with .0005 condenser attached; two Neutralizing Condensers. Also illus. book.
N8778 Radio Frequency Kit $13.85



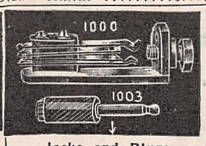
Throw Switches

Mounted on composition block. Small enough for all radio purposes.
N4100 Single pole...$.25
N4101 Double Throw Single Pole .....$.35



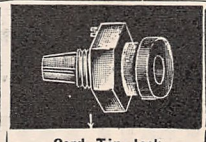
Bakelite 180° Coupler De Luxe Style

Tubes of natural color bakelite, wound with green silk. Cast aluminum bracket, ¼" shaft. Primary 13 taps. 180 to 550 meters.
N3150 Coupler $2.35



Jacks and Plugs

Best materials. Silver contacts. Factory making Postal Telegraph jacks, makes these.
N1000 Jack 4 springs $.65
N1001 Jack 3 springs .75
N1002 Jack 5 springs .80
N1003 Plug ..... .35



Cord Tip Jack

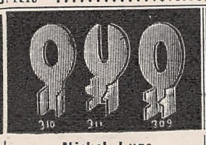
Takes place of binding posts. Cord tip firmly gripped by jack. Made of brass, nickel plated. Screw to attach lead wire. No soldering necessary.
N1500 Cord tip jack. Each .....$.15

Series Parallel Switch

Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1¼".
N2950 Series parallel switch .....$.25

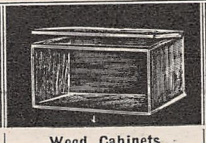
Melotone Loud Speaker

Best popular loud speaker. Fibre horn, heavy metal base, five ft. cord. Nickel gooseneck. Greatest tuned (adjustable) talker. Horn length 11½"; bell 6⅝"; total height 9".
N255 Melotone Speaker $4.00



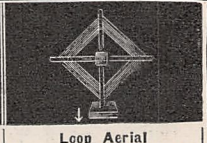
Nickel Lugs

All lugs are tinned.
N310 Brass Lugs for No. 8 screw, doz. .....$.10
N311 Copper Lugs for Nos. 6 and 8 screws, dozen .....$.10
N309 Copper Lugs for Nos. 4, 6 and 8 screws, doz. .....$.10



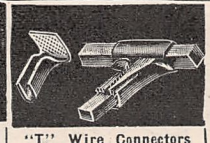
Wood Cabinets

Highest grade mahogany cabinets made. Top is hinged. Made of ½" stock.
N710 Panel, 7x10" $2.60
N712 Panel, 7x12" 3.00
N714 Panel, 7x14" 3.15
N718 Panel, 7x18" 3.40
N721 Panel, 7x21" 3.75
N724 Panel, 7x24" 4.20



Loop Aerial

Made entirely of well seasoned hard wood. Complete with all parts and base. Total height of loop 36". Can be put together by anyone in less than 5 minutes.
N2600 Two ft. loop aerial, complete $1.15

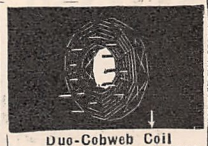


"T" Wire Connectors

This big little article solves all troubles when making "T" wire connections. Made to take 1/16" square or round bus-bar wire. Can be attached with a pair of pliers.
N2975 "T" Wire Connectors, 12 for $0.05

Nickel Screws

Made of brass, nickel plated. Flat and round head style. Any thread up to 10/32".
Price, ¼", ⅜", ½" long, dozen .....$.15
Price, sizes ¾" and 1" long, dozen .....$.30



Duo-Cobweb Coil

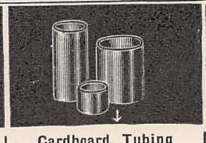
For Reinartz circuit, 200-600 meters. 19 taps. Size 4¼" diam.; 1⅞" center opening. Coil is firm and will not fall apart.
N2650 Cobweb Coil $1.15
N2660 Coil for panel mounting. 225-600 meters $1.90

Binding Posts

N030 Sm. size, ½" high, nickel finish, each...$.04
N124 Initialed Binding Posts; Antenna; B. Bat. —; A. Bat. +; B. Bat. +; A. Bat. —; Ground; Phone; each .....$.06
N45 Spring Posts, ea. .04
N44 Spring Posts, ea. .07

Double Phonodapter

Fits all phonographs and will take any standard double head set, thus making your phonograph a loud talker. Made of cast metal, nickel plated. 3 soft rubber bushings.
N1320 Double Phonodapter .....$.65

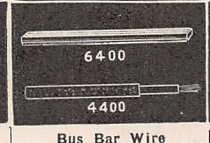


Cardboard Tubing

Only seamless tubing made (I.—Inside Diameter. O. —Outside Diameter. L. —Length). **N6600,** 3" I., 3¼" O., 7 L....$.30
N6601, 3½" I., 3¾" O., 7" L., $.35; **N6604,** 4" I., 4¼" O., 5" L., $.35; **N6605,** 2¾" I., 3" O., 2⅜" L.....$.15

Radio Cement

Weather resisting. Used particularly for cementing covered wires. Coils covered with this cement require no form. Wires hold together solely with this cement.
N1750 Cement, 2-oz. bottle .....$.50



Bus Bar Wire

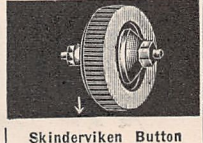
Square wire, 1/16" x 1/16", already tinned, making soldering easy. Sold in 2-foot lengths only.
N6400 Bus Bar, length .....$.05

Green Silk Cord

Rubber Insulation.
N4400 Per foot.....$.02

Phonodapter

Will fit any phone. Make your phonograph a loud talker. Fits all phonographs. Made entirely of pure soft rubber with brass tube insert.
N1310 Phonodapter..$.38

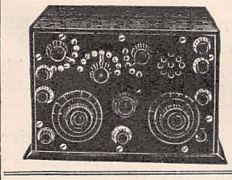


Skinderviken Button

Famous Microphone for Transmitters. Sold all over for $1. This is the genuine article. No imitation. Smallest and most sensitive microphone made. Diameter ¾".
N9895 Microphone..$0.85

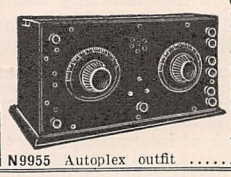
COMPLETE SET SALE AT REDUCED PRICES

Reinartz Receiver



Exactly as shown with mahogany cabinet, panel, all necessary instruments, binding posts and pattern for assembling. This set can be put together by anyone in a few hours. You can cover 1000-1500 miles easily with this set.
N9988 Reinartz Receiver $13.50

Autoplex Circuit



Will bring broadcast on loud speaker on single tube. Complete as pictured here. All parts, including mahogany cabinet, panel, instruments, binding posts, etc. Can be put together in a few hours time.
N9955 Autoplex outfit **$15.00**

Wanted

This Company is always in the market for new ideas. Any small specialties in demand by the radio fan will be highly welcomed by us. Some of the articles shown on this page originated with our customers, whom we paid well for the ideas. Send your sketch or model addressed to Research Department, c/o this Company.

N6060

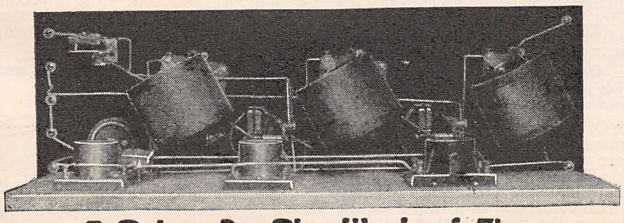
SPECIAL

Genuine RICO 2000 ohm double head set. Standard phone with 6-foot cord. Tripole type. Regular price, $4.00. Our special price **N6060.**

$2.50

Money back if not satisfactory.

NEUTRO-REFLEX—The Wonder Circuit!



3 Tubes Do The Work of Five

500 MILES ON LOUD SPEAKER

Here is one of the most talked of radio circuits that has been produced this year. Why build a five tube Neutrodyne receiver when the NEUTRO-REFLEX will duplicate the results on three tubes? This famous circuit was developed by Clyde Fitch, and was fully described in **RADIO NEWS** for August, 1924, pages 188-189. Practically the same outfit is now made by one of the largest Neutrodyne manufacturers. This circuit does the work, brings in the distance AND has the same volume as a five tube Neutrodyne set. NO NEUTRALIZING CONDENSERS ARE NEEDED WITH THE NEUTRO-REFLEX. Uses three 201A tubes.

Our outfit comprises all necessary parts to build this set as follows: 3 "Rico" NEUTRO-TRANSFORMERS; 3 "Pilot low-loss 21 Plate Condensers; 2 "Rasco" standard Audio Transformers; One "Rasco" Jack; One "Rasco" Grid-Leak Condenser; One "Rasco" .001 Fixed Condenser; 3 Bakelite Sockets; 3 "Rasco" 30-ohm Rheostats; One 7 x 21 Mahogany Cabinet; 7 Binding Posts; One 7 x 21 Dilectryte Panel; 30 feet Bus Bar Wire; One Base-Board; 7 Binding Post Nameplates; One set of directions, Blue Prints, etc. Total price of the goods listed.....$25.83

OUR SPECIAL PRICE FOR THIS MONTH ONLY **N5599.....$25.25**

The "Rasco" Catalog

CONTAINS 75 VACUUM TUBE HOOK-UPS, 300 ILLUSTRATIONS, 500 ARTICLES, 84 PAGES

FREE A POSTAL BRINGS IT

All Armstrong Circuits: These important circuits are explained clearly, all values having been given, leaving out nothing that could puzzle you.

Just to name a few of the Vacuum Tube circuits: The V.T. as a detector and one-step amplifier; all Armstrong circuits; one-step radio frequency amplifier and detector; three stage audio frequency amplifier; short wave regenerative circuits; 4-stage radio frequency amplifiers; radio and audio frequency amplifier; inductively coupled amplifier; Armstrong superautodyne, etc.

RADIO SPECIALTY COMPANY, 98 PARK PLACE, NEW YORK CITY

1934 Trained Factory Representatives

Are Now Entitled to Wear That Button

Ozarka Four Tube Sets As Low as

$39.50

Radio With Service

OZARKA radio instruments are demonstrated, sold, installed and serviced by direct factory representatives only. These men have been thoroughly trained by our own engineers who designed and perfected Ozarka.

The success of any radio instrument, like the automobile, depends on the quality of service rendered.

No matter how perfect any radio instrument leaves the factory, little things may sometimes go wrong. You've no doubt learned, by costly experience, that the ordinary handy man cannot properly service your automobile. The same is true of Radio. Troubles are generally caused by very little things which are exasperating to the owner, but are quickly corrected by the man who is trained on that instrument.

Today 1934 factory trained representatives are authorized to wear the Ozarka button. These men know Ozarka perfectly; more are now being trained; soon there'll be one in every town.

Without obligation to you, the Ozarka representative will set up an Ozarka in your home on trial. He won't claim that it is better than others. All he asks is the opportunity of letting the Ozarka do its own selling. With *your own operating* you must satisfy *yourself* that it has no equal for volume, tone, distance and ease of operation.

The Ozarka Representative will erect the most effective aerial possible. He will teach every member of your family how to receive results from your Ozarka which will make you the envy of your radio friends. More than this, he *can* and *will* keep your instrument working perfectly at all times. Ozarka quality speaks for itself. Ozarka prices, quality considered, are low. $39.50 and up.

Let us send you the stories of Ozarka long distance reception—from many people who have heard London and Manchester, England; Cardiff, Wales; Glasgow, Scotland; Buenos Aires, South America; and even Honolulu, H. I. Write for *free* illustrated book No. 200. Please give name of your county.

Ozarka Offers Real Opportunities

It is not exaggerating to state that hundreds of thousands of homes are waiting for "Radio with Service."

In other words they are waiting for the Ozarka trained man. Already we have 1934 such representatives, and the field is barely scratched. Ozarka training is very thorough, intensely interesting, and quickly absorbed through study in spare time, by any man who is mechanically inclined.

Three other qualifications are necessary: the desire to better your condition, willingness to work, and at least a little capital.

You may not think that you possess the necessary selling ability. But with the qualifications just mentioned, plus Ozarka training, you can and will talk convincingly of what Ozarka will do—and you can set up the Ozarka instrument in the approved manner that insures satisfaction.

Lack of information is keeping thousands and thousands of prospective purchasers from enjoying radio. They think that operating a radio is the job of an expert. They fear that their investment in a radio instrument will not bring the results they want.

This situation is "made to order" for the Ozarka man. He has only to let the Ozarka Receiving set do its own talking—its results will sell itself—and thus convince folks that is the set they want. He sells it on the basis of satisfaction guaranteed—sets it up all in first class working order—and keeps a supervising eye on the installation until familiarity has resulted in confidence.

The Ozarka Plan offers you more money, more independence, and possibly your first real opportunity to build up a permanent, profitable business of your own.

The Ozarka plan is fully described in a large illustrated book. A copy will be sent to men who are willing to tell us fully about themselves. Unlike any book you have ever read, the Ozarka book is a true story of life, of men, of why they fail, and how they succeed. It is founded on the principle that nothing is impossible to the man who is determined and willing to try.

In territory not now covered, the right man is wanted. The investment in money is small, but investment in time and study is considerable. If you are willing to put forth the necessary effort to obtain a splendid profitable business of your own, write and say "Send me your Ozarka Plan Book No. 100." It may be the turning point in your life. Don't fail to mention the name of your county.

OZARKA, INC., 804 Washington Blvd., Chicago, Ill.

RADIO NEWS

H. GERNSBACK, Editor and Publisher
ROBERT E. LACAULT, Associate Editor

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Vol. 6 NOVEMBER, 1924 No. 5

For Better Radio

By HUGO GERNSBACK

WHEN we come to analyze radio reception as it is at present, we are confronted immediately by the word interference. A first-class set that tunes exceedingly sharp is a boon and at the same time very elusive. A first-rate set using, for instance, regeneration, tuned radio frequency or the Super-Heterodyne principle, will tune sharply with certain exceptions. The exceptions are due to locality. A set which tunes so sharply that it can eliminate any station and bring in another at will, may work exceedingly well in the country and yet give little satisfaction in the city, or perhaps *vice versa,* depending altogether upon locality. So, the inherent fault does not lie so much in the design of the set, but in the location, as already mentioned. And most important, it is the broadcast stations which cause most of the interference.

To give an example, suppose you have an excellent radio frequency or Super-Heterodyne set which brings in great distances. Suppose you are located in Chicago and you wish to listen in to, let us say, WBAO located at Decatur, Illinois. This station operates on 360 meters wave-length which is 833 kilocycles. But if you will consult your broadcast station list you find that in the country there are no less than 163 stations transmitting on this particular wave-length. Now, there is a strong chance that a dozen of these may be operating at the same time. It is true that some of them may be 1,000 miles away. But the very fact that your set brings in the far away station begins to operate to its detriment. The chances are that you will not be able to tune in WBAO. As a matter of fact you may pick up another station operating on 360 meters—833 kilocycles—or you may not be able to tune in to a 360 meter station at all, as several of the stations operating at this wave-length may be heterodyning each other. This, in simple language, means they are interfering among themselves. A good analogy of this would be a dozen pianos, standing in a big hall. If six out of the twelve pianists were all to strike simultaneously the key A flat, it would be impossible for you, no matter how well you were listening, to tell which one particular piano was sounding. They would all come to your ear with the same sound frequency. But suppose again you have eleven of the pianists striking the A flat and one among them strikes the high C; immediately you would be able to pick out that piano from which high C originated. Exactly so in radio.

The trouble in radio today, particularly in this country, is that broadcast stations operate either on the same wave-length or on wave-lengths separated insufficiently to make tuning easy. No matter how sharp the receiving instrument may tune, either now or in the future, it will be impossible for such a set to separate the stations operating on practically the same wave-length.

It is a fact that the shorter the wave-length becomes, the easier it is to separate the various stations. For instance WOAW operates at 526 meters, 570 kilocycles. In order to preclude the creation of interference immediately below and above this wave-length the next wave-length at which a station may operate must be separated from the former by several meters. Thus WCX, 517 meters, 580 kilocycles, is separated from the 526-meter station by 9 meters, while the next station immediately above, namely KYW, 536 meters, 560 kilocycles, had to be separated by a full ten meters.

On the other hand the lower we go down in the wave-length the easier it becomes to separate the stations. This is because of the fact that the lower the wave, the higher the frequency in kilocycles and when you tune sharply it is not the wave-length which interests us so much as the number of kilocycles by which the stations are separated. For instance, station WHAG operates on 222 meters or 1,350 kilocycles, while station KFOB operates on 224 meters or 1,339 kilocycles. Although the two stations are only separated by two meters there are eleven kilocycles between the two stations—enough to enable a good set to tune in either one of them without interference from the other. The further we decrease the wave-length the easier it becomes to sharply tune to the various stations.

For instance, if we could produce and use—and shortly we will—say a 4-meter wave-length, we would find this wave-length to have 75,000 kilocycles, while at 5 meters we should find 60,000 kilocycles. In other words, between the wave-lengths of four and five meters, we have a difference of 15,000 kilocycles. This translated into every-day language means that all the broadcast stations in the entire world, even if there were 5,000 of them, operating simultaneously could comfortably work without interference between the wave-lengths of five and ten meters—a startling fact, but true.

The authorities in Washington already have come to this conclusion and the Department of Commerce will shortly rearrange wave-lengths on a different scale. At the present time there are more than 500 broadcast stations operating on wave-lengths between 545 and 222 meters. Soon this will be changed to 545 to 200 meters. While this may help the present situation, the chances are that in the distant future all the broadcast stations will be operated on waves far below 100 meters. While there is, of course, no likelihood of this being brought about immediately, the trend of the times is in that direction.

When Wireless, as it was then called, was young, it was common practice to operate stations from 6,000 to 16,000 meters. If such wave-lengths had been adopted for broadcasting it would be almost impossible to separate the stations unless their wave-lengths were hundreds of meters apart. But we slowly are learning that the short wave-length is a step toward the ultimate in efficiency. For one thing—and this is quite important—the lower the wave-length, the less interference there will be between stations; but still more important, at wave-lengths below 20 meters static is a thing of the past. No more crashes in the phones or loud speaker! Almost uncanny quiet reigns in that low region of the wave band.

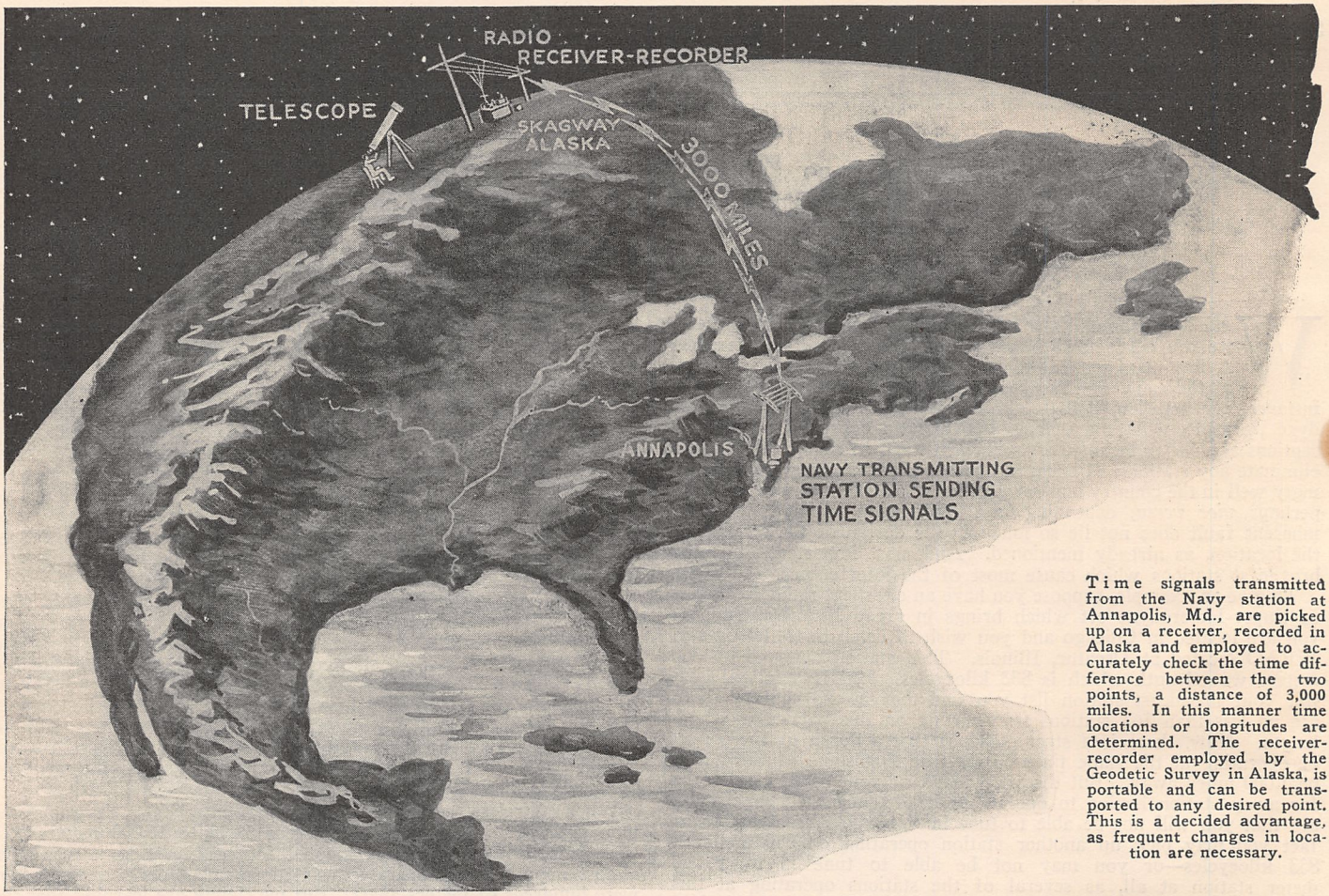
Nor is this all. At the present time, as every radio fan knows, it becomes almost impossible to pick up a distant station during daylight. Not so with the low wave-lengths. With them daylight does not seem to affect transmission at all, nor is fading noticeable. Recent experiments have been made with a 90-meter wave-length, and European stations came in quite well during the daytime with no fading. Station KDKA, Pittsburgh, which has been transmitting on an extra short wave of 68 meters comes in just as loudly during daylight as at night. The same is the case with Station WGY which is now broadcasting on a wave-length of about 15 meters and is covering tremendous distances. It is as yet more or less difficult to build receiving sets operating at such low waves, but all these things will be solved in short order.

The writer well remembers, when in his editorial in the February, 1912, issue of *Modern Electrics* he first advocated that amateurs be allowed to use a 200-meter wave-length. The amateurs themselves ridiculed the idea and the law-makers in Washington were only too glad to assign this low wave-length to the amateurs, because the authorities then thought it certain that it was impossible to receive and transmit at such a "ridiculously" low wave-length. Nevertheless the writer was completely vindicated in the years that followed and the amateurs, thrown upon their own resources, had to find means of operating at this wave-length. The tremendous distances they have covered and are covering every day using this wave-length is sufficient proof that it was not impossible. The writer feels certain that within the next ten years all broadcast stations will operate on wave-lengths below ten meters.

Determining Longitude by Radio

By C. H. SWICK

How the Coast and Geodetic Survey has successfully employed radio as a means for determining accurate longitudes at isolated locations.



Time signals transmitted from the Navy station at Annapolis, Md., are picked up on a receiver, recorded in Alaska and employed to accurately check the time difference between the two points, a distance of 3,000 miles. In this manner time locations or longitudes are determined. The receiver-recorder employed by the Geodetic Survey in Alaska, is portable and can be transported to any desired point. This is a decided advantage, as frequent changes in location are necessary.

FOR the past three years the Coast and Geodetic Survey has successfully made use of the Naval Observatory radio time signals sent out through the Annapolis radio station in determining accurate longitudes both in the United States and Alaska.

The use of radio for determining accurate longitudes on land is a new and important development in the radio field. Mariners have, of course, depended for several years upon radio time signals for obtaining longitude at sea. They have used the audible method for receiving the signals and have compared the signals directly with their chronometers. This method is not accurate enough, however, for longitudes on land, as a tenth of a second of time is far greater than the allowable limit of error for this class of work and it is doubtful if the audible reception of radio time signals can be depended upon even that closely.

It became necessary to devise some automatic mechanical method for receiving and recording radio signals if they were to be used for land measurements. Various kinds of apparatus for this purpose have been in use in observatories and laboratories for some time, but none of them were found to be suitable for field conditions, being either too heavy and cumbersome to be transported conveniently or too delicate and complicated for field use.

At the request of officials of the Coast and Geodetic Survey, the Bureau of Standards undertook to design the required apparatus. Dr. E. A. Eckhardt and Dr. J. C. Karcher, physicists at the bureau, after careful experimentation, finally succeeded in constructing a radio recording device which has given excellent results. It has recorded the Annapolis time signals as far away as Skagway, Alaska, about 3,000 miles. The difference in time between Washington and Alaska made the regular 10 p. m. time signals too early for the necessary star observations in Alaska, which should be made near the time of the signals, and so the Naval Observatory sent out special time signals at 4 a. m. while the Alaskan work was being done.

THE APPARATUS

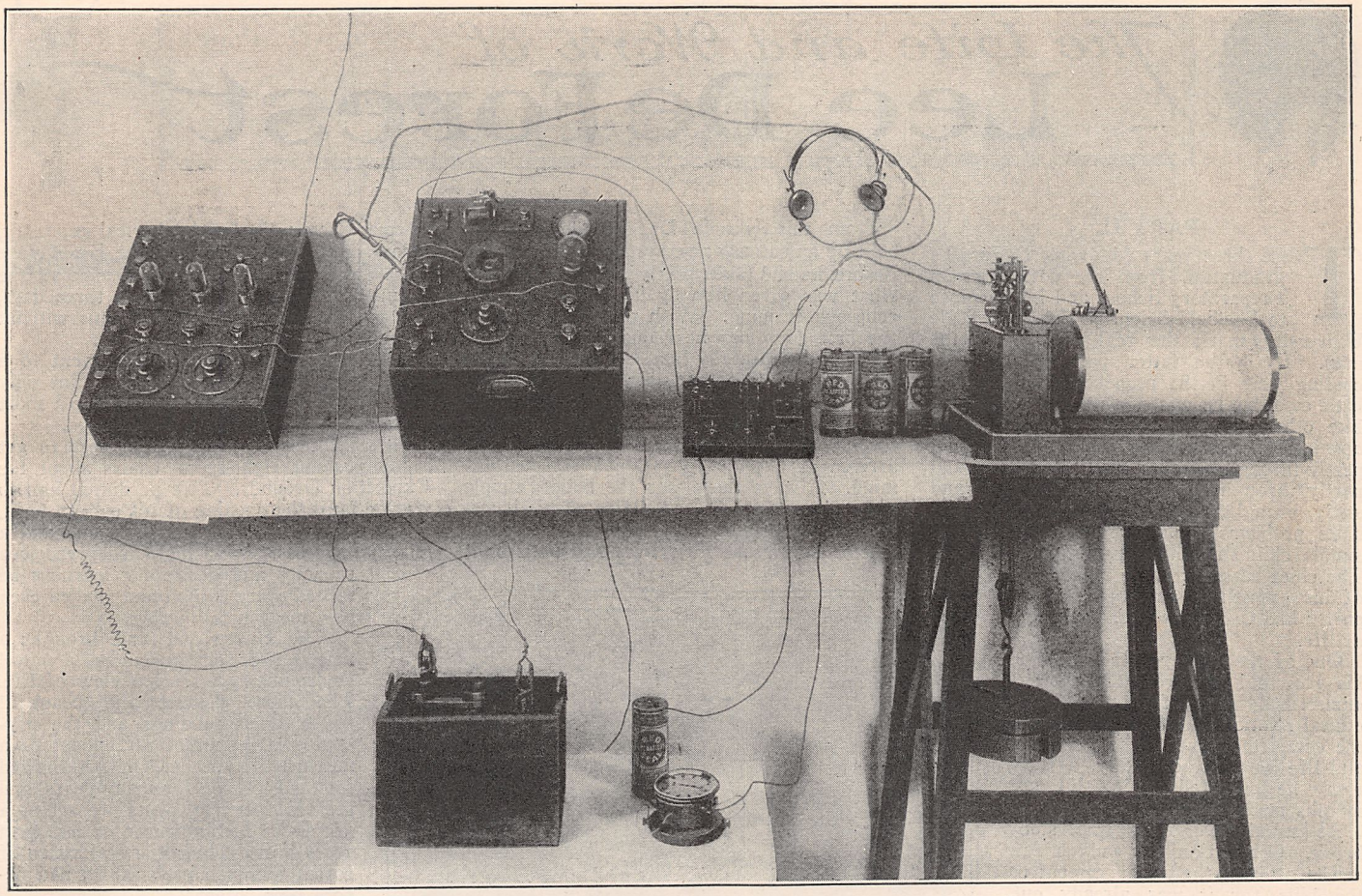
The new recording apparatus consists of a receiving set with a special sensitive relay which is operated by the incoming signals, which, in turn, operates the pen of a chronograph and makes a pyramid in the line traced on the chronograph sheet. The local chronometer is also connected with the pen through another relay so that it, at the beginning of each second, makes another pyramid in the line on the chronograph sheet. The result, therefore, is a permanent record of a direct comparison of the local chronometer with the Naval Observatory clock and this enables the difference of longitude to be computed. A small section of a chronograph sheet is shown in an accompanying illustration.

Longitude is the distance of a point in degrees minutes and seconds east or west of the meridian through Greenwich, England. The most convenient and accurate way to measure longitude is to determine the difference in time between some place whose longitude is known and the place in question. For example, when it is noon at Greenwich it is 51 minutes and 44 seconds past 6 o'clock, a. m., local mean time (not standard time) at the Naval Observatory, Washington, D. C. The difference in time between the two places is, therefore, 5 hours 8 minutes and 16 seconds, and this corresponds with 77° 04′ 00″ of longitude.

To measure the difference in the longitude of two places it is necessary to make star observations to determine local mean time at both places, and then to send some signal or series of signals which will travel practically instantaneously from one station to the other to find out how much the time at the eastern place is faster than the time at the western place.

It was formerly the practice to transmit these signals by wire telegraph or cable line or by a combination of the two. This required each station to have a temporary wire connection with some telegraph office or line and so involved considerable expense.

Now that radio signals are used in place



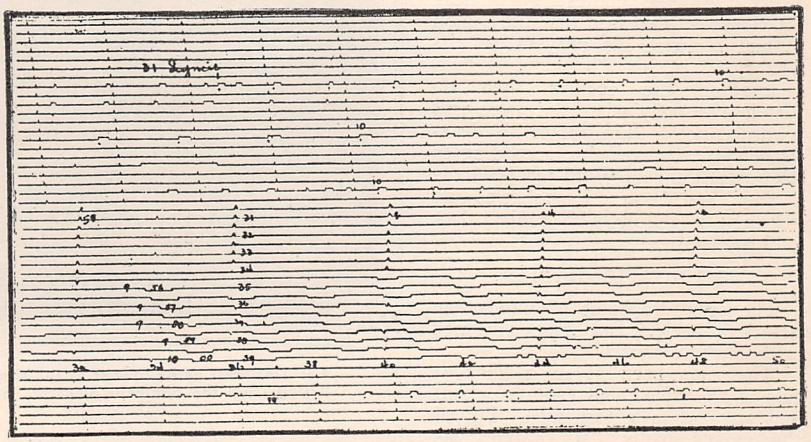
The radio receiver-recorder employed at Skagway. Both the chronometer (under the table) and the radio receiver are connected to relays which actuate separate pens on the chronograph. The chronograph is seen at the extreme right of the photo. The relays are to the left of it.

of the wire signals there is practically no restriction in the location of stations. They may be placed anywhere the equipment can be carried no matter how far from railroads and telegraph lines. This is a great advantage as it makes possible accurate longitude determinations on small islands, at the tops of mountain peaks, or in the interior of jungles.

The tests of the radio method during the past two years or more seem to indicate that it will give even greater accuracy than the wire method. The various relays and repeaters in a telegraph line introduce a variable lag in the transmission of the wire signals—that is, an appreciable time is required for the signals to go from one station to the other and this time varies for different stations. The only lag in the radio signals is due to the receiving and sending sets and this lag may be measured and an allowance made for it. The speed of travel of radio waves through the air is about 186,000 miles per second which means, of course, that the transmission time is practically zero although corrections are made in the computations even for this small amount.

The radio recorder has been found very useful in other lines of work. For instance, in measuring the intensity of gravity it is necessary to determine the time required for a pendulum to make one oscillation with an error less than one one-millionth of a second. The rate of the chronometer with which the pendulum is compared must therefore be determined very carefully and accurately. Formerly this was done by making star observations at each station but now the chronometers are compared directly with the Naval Observatory clock by means of the wireless time signals and all the trouble and expense of making star observations is avoided.

The radio recorder may also have commercial value both for making permanent records of important messages and also in saving the time of skilled radio operators.



A specimen chronograph sheet showing how the time signals and the chronometer readings are recorded side by side.

Clearing the Ether of Electric Power Noises

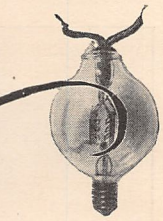
AN organized effort is being made by the electric light and power companies to eliminate electrical interference other than radio type, which, of late, is the cause of considerable complaint from radio fans. A sub-committee on radio of the inductive coordination committee of the National Electric Light Association headed by H. P. Liversidge has just reported on its investigations, the results of which are pleasing to most of the companies following up complaints of radiation.

The committee feels that the power companies should confine their service activities to their own lines and equipment, or such as they sell to customers. They are hardly justified in tracing causes of radio interference located on customers' premises, it is said, although asked to do so in many instances. Complaints of such interference, however, it is recommended, should be studied and classified and forwarded to a central office for reference, until the problems are better understood and the technique of locating the trouble is perfected by operating companies. The committee believes that a special type of receiving set, satisfactory for distant reception on loop aerials, should be employed for preliminary observations to determine the sources of interferance. Experiences indicate that such a set combined with a less sensitive outfit, such as an exploring coil and audio frequency amplifier, will give good results.

Future recommendations as to activities

(*Continued on page* 804)

The Life and Work of Lee DeForest



PART II.

THE three years following DeForest's graduation from the Mt. Hermon Preparatory School and his entrance to Sheffield Scientific School of Yale University mark the real growth of the man. Until the latter part of his concluding year in the prep school, there was little evidence he was more than a youngster like others of his station and age. The opening of new vistas, which came about partly through his own questioning brain and partly through the stimulus of reading and study, brought him to a realization that all life's problems could not be solved by the simple childish faith taught him at home. The chief reason for the retardation of his growth to manhood may be partly laid to a lateness in discovery of life.

One of the most potent factors in his growth away from the old circumscribed view of humanity and ethical relation and the realization of the complete science of the universe and life was, paradoxically, a Bible essay he prepared during his last months at Mt. Hermon.

As usual, DeForest was stony broke. Graduation was only a few weeks off and the announcement of the bills for it was already out. While in the midst of deep contemplation as to where the necessary funds for graduation might be obtained, an announcement was made to the effect that a prize of fifty dollars would be given for the best essay on some Bible theme. DeForest saw his chance. He immediately began work on an essay. Following the teachings of his father, and noting the worthiness of the subject, he began to pray, night and morning, for the success of his essay. As the contest grew near its close, he increased his study upon it and likewise his prayers for its victory.

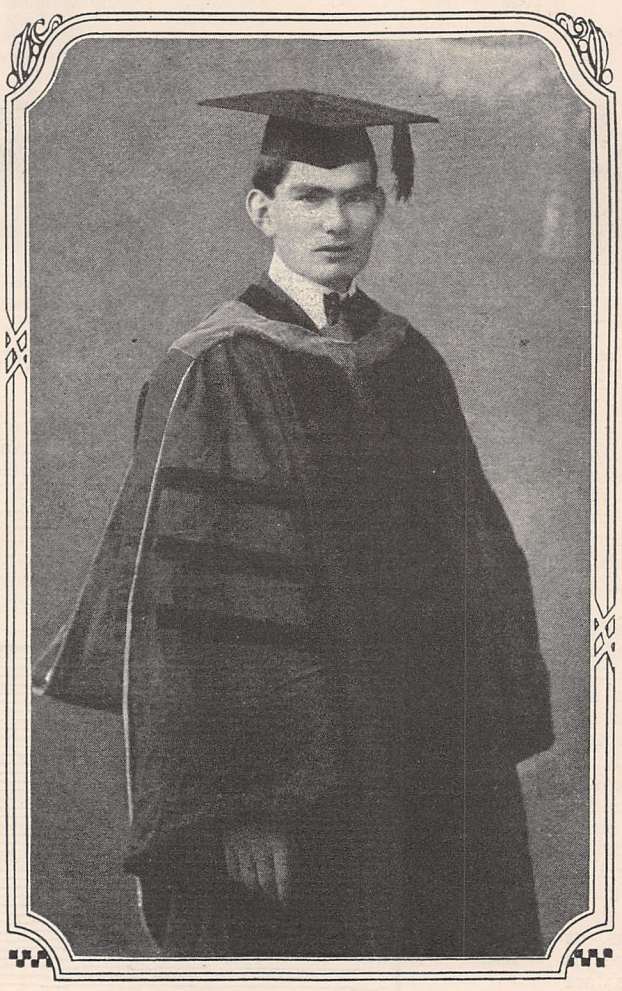
Imagine the feeling then on Graduation Day when the prize was awarded not to him but to his dearest enemy, a chap who, according to DeForest's memory did not need the money at all and who was no scholar; a fellow who ranked low in his classes.

SCIENTIFIC HABITS

The scientific habit of mind then asserted itself. DeForest reasoned with himself thus:

"God has been given a chance; this is an experiment even as a salt and an acid in a test tube. I need the money badly. My father has spent his life in the service of God; I have always been devoted to His ways, and now, when I am in great need for the sake, not of myself, but my father, God chooses to grant this prize to one who has little necessity for it. The Bible promised me this, if I had faith; and my faith was absolute. I must believe that God is great and good and will not wilfully cause pain and disappointment. Therefore, the only conclusion which I may draw from the observed facts is that God does not take a hand in the regular affairs of man. He delegates the running of things terrestrial to certain inflexible laws and does not interfere for special cases, not even for faith."

From this episode DeForest began and built up an entirely new system of life values. Before, he had taken pretty much for granted what was given him by his father and his religious training. With the awakening of the first doubtings he found it necessary, in order to be mentally honest with himself, to construct his ideas and ideals to conform to observance and his own logical processes. The fight was a long and bitter one. Nearly three years were consumed before he finally arrived at a philosophy which satisfied his mind. Always there was the belief, simple and unreasoning, in the religion of his home. He had utter faith in his father and mother and he knew that their lives had been built upon a foundation of this faith. As a result, all of his questioning into its validity made him feel as though he was being disloyal to them.



Lee DeForest as he looked at the time of his graduation from the Sheffield Scientific School of Yale University.

The vacation period intervening between his last year at Hermon and his matriculation at Yale was so filled with interest that he had little time to follow up the problems.

He began the vacation by doing something absolutely unheard of in the annals of that school. For two weeks, night and day, 14, sometimes 16 hours a day, he "boned," "crammed," studied like mad for his entrance examinations at Yale. Some of the subjects were completely new to him. He read three entire new books of the Aeneid, re-read Caesar, mastered spherical geometry, trigonometry, etc. Then on the last day he went down to New Haven and took all the exams—preliminary and final in three days, and passed every one, entering thus without a condition.

Then for his "vacation." He went to a small town to sell books again. But only until he had saved enough to pay for a short visit to the World's Fair in Chicago.

He was lucky enough while there to get a job pushing sight-seers' chairs about the Exposition Grounds. This permitted him to stay on until the opening of his college term.

The venture was an enjoyable one and a financial success. With his usual precocious capacity and desire for learning he visited every exhibit and studied each new mechanical display.

New Haven and Yale brought a new set of circumstances, a novel environment, a foreign view of life. The more perfect and beautiful physical surroundings and the psychological effect of attainment of a measure of success (he had looked forward to Yale for many years, and the realization of what we set as a success is nothing more or less than goal) brought him to a realization of forces within himself which had before been latent.

Adversity, that Dean of the School of Experience, took a personal interest in this combative pupil. DeForest's early training had given him a queer conception of the world and its forces. He considered nature as being entirely against him; everything must be won by hard fighting. This belief grew out of his early teaching which postulated a Devil always waiting to devour the unwary or lazy. The result, in the end, was a pugnacity and a constantly egotistic attitude toward those around him and to life generally. It gave him a belief in hard work that prepared him for an almost unimaginable amount of it. Heredity donated an indomitable will to this mixture.

HIS FELLOWS

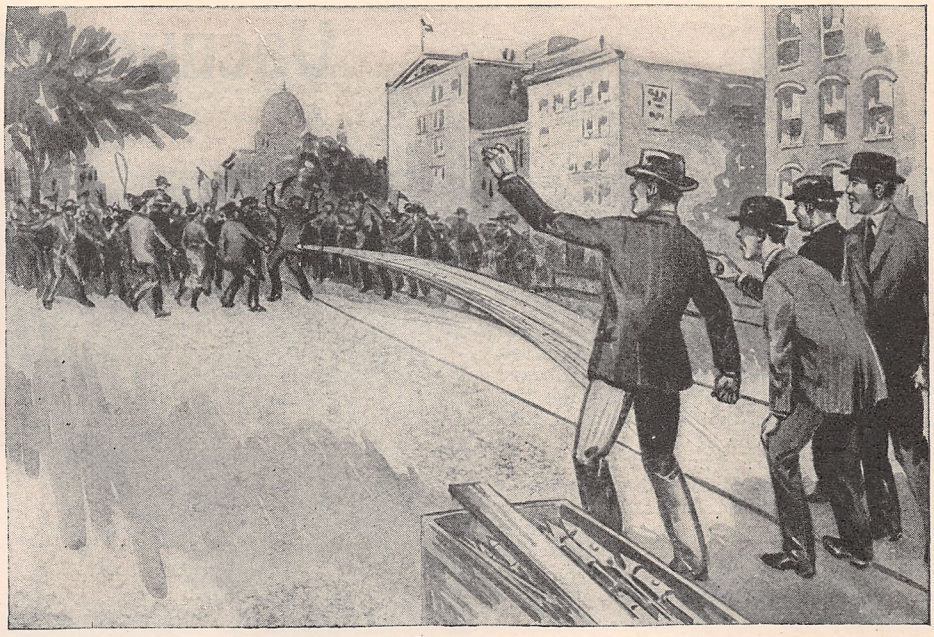
His belief in the shallowness of most human beings left him very exclusive as to companions. At Mt. Hermon he had no friends, as the word is ordinarily understood; and at Sheffield the same condition obtained for the most part of the first year. He did not cultivate companionship—possibly because he had not the first idea how, since his early life had been spent entirely alone. Most all his potential friendships of the first years were immediately nipped before they had even a chance at development by DeForest's characteristic extreme righteousness.

He went about the town with fellows of his class but he was not *of* them. Really, he did not understand them at all. When romance winked he followed and enjoyed himself, only to return home and write of the sordidness of stolen kisses and sweet vows. When vivacity and jollity held forth on the stage he likewise partook deeply, only to repeat the formula of self abasement by writing a criticism of time wasting devices. Many such encounters with the lighter side of life he essayed to enjoy with others, but since he could never take

Biography recorded by W. B. Arvin of Radio News, *under the personal direction of Dr. DeForest. Copyright* 1924 *by E. P. Co.*

the joy of the occasion frankly, since he always considered such enjoyment as a crime in violation of his conscience, his companions did not have the feeling of a community of interest; and since none of them were forced into the same battle against narrow minded conscience they had no understanding of him and hence made no real friendship. Consequently, DeForest grew more and more into himself, fighting his interminable battle for knowledge.

Since his present observation was so thoroughly opposed to his early training, the latter naturally slowly gave way. This process is an interesting development. He discovered Spencer and Thomas Henry Huxley and read them. Naturally, their logic sounded much better than the allegorical tales of creation given in the Bible. De Forest immediately decided against his early training and became an adherent of evolution. This ushered in a larger problem. What about a soul? His early training had been that the soul was the most important part of man and the evolutionary studies seemed almost to rule it out. In trying to correlate the idea of the Soul and Evolution he evolved some extremely naive explanations. He would study hours in an attempt to find the proper explanation for the entry of the soul into the body.



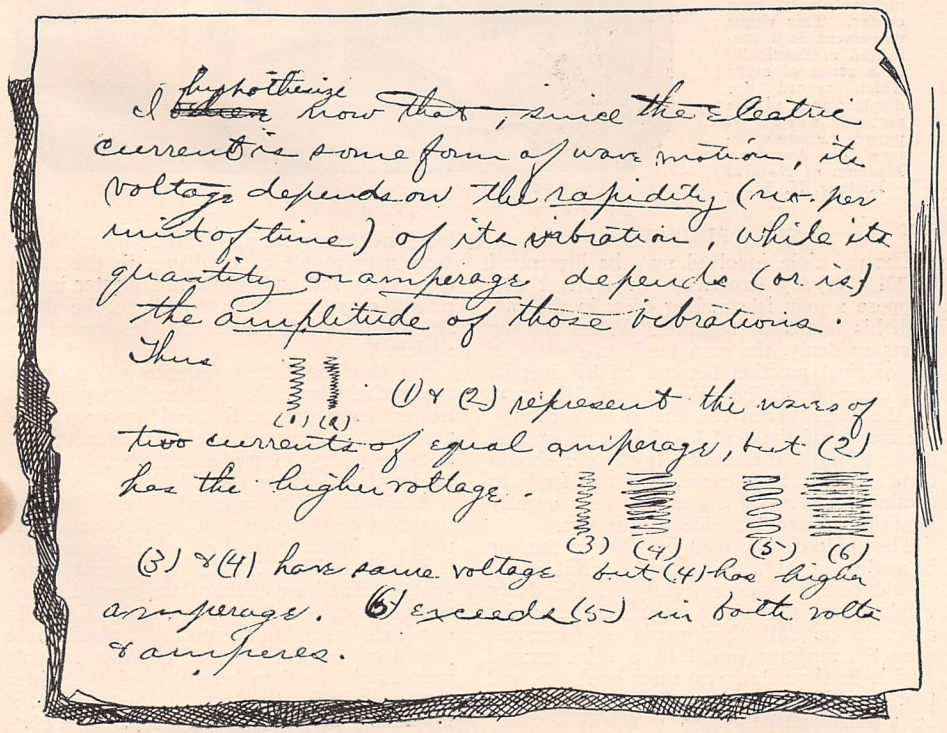
The lighter side. At a celebration DeForest put a sky rocket to a very novel use. Joy was added to the stunt by the accuracy of his aim.

PHILOSOPHY

All during the first year at Sheffield, his free hours were spent in the reading and study of philosophy. His position shifted gradually from the faith of his father to a rationalistic, scientific one. After the conception and acceptance of this new position in theory a second year was required for putting it into practice. By his last undergraduate year the change was complete. The new DeForest was as foreign to the original bumpkin who entered the school three years before as quail is to hamburger, yet he carried just as strong a belief in his new faith as he did in the old and we find him preaching for broadmindedness in his last year just as heartily as he cried for moral reformation in his first. From absolute absence of social contact, which was his state at the beginning of the Yale period, he developed into the normal gregarious human being before the end.

Never being extremely brilliant, as the word is generally meant, but rather slow and deep thinking, there was a sort of momentum to his mental power which seemed to force him to an inordinate amount of work. His one method was to force down obstacles by sheer weight of energy and work. The ability to take advantage of a favorable circumstance, or to use personality or "pull" to gain a desired end was not in him. Besides, his unflagging self-reliance and pride—maybe not exactly pride, for it was really nearer a complete self-dependence bred of his early training—forced him to this position.

Aside from carrying the regular course of studies, which was found sufficient to keep most men busy, the first year at Yale he worked in the psychological laboratory as a means of supplementing his allowance, made and attempted to market four major inventions and several minor ones, carried on a reading course in electricity, failed miserably in one love affair while making a success of numerous flirtations, attended all the school's athletic games and wrote nearly fifty thousand words for his soul's sake on his philosophical meanderings. Withal he ranked well up in the first division of his classes and was given honorable mention for scholarship in chemistry. His ambition was to take the general excellence scholarship prize, but German prohibited. He went to church every Sunday and to a student Bible class on Wednesday nights, as well as joining in the evening-long celebrations which followed every athletic victory. This extreme activity was a characteristic which followed him through school.



One of DeForest's first essays in the field of pure electrical science, showing his theory of electrical phenomena.

FIRST INVENTIONS

The first Yale invention is noteworthy if it was not a success. It consisted of a novel method of joining the forks of a drawing compass. After conceiving the idea he submitted it to paper and then wrote the specifications. As soon as it was complete he sent it to Keuffel and Esser in an attempt to sell it.

The invention was returned in a short time with the notation that it was unavailable since it necessitated drilling a hole through the center of the yoke. De Forest, upon this decision, promised himself never again to attempt invention in a field promising so little room for original achievement.

His second invention took the form of a puzzle. At the World's Fair, which he attended the previous summer, a small fortune was made with such a device and DeForest hoped to do likewise. After submitting it to eleven firms and having it returned unaccepted a like number of times he decided that possibly the idea wasn't marketable!

The most pretentious essay of the year was the design of a new trolley car system submitted in competition for a $50,000 prize contest held by a New York rapid transit company. For more than six weeks he used every spare moment for the perfection of his germ idea. He submitted it to paper, as before, with an elaborate set of specifications, sent it to an expert for criticism, and waited in agony for the outcome. But without making an award the board of directors of the company announced the contest had been called off.

(*Continued on page* 836)

Vacuum Tube Oscillators

By J. E.

SHORTLY after the Japanese earthquake in the fall of 1923, a non-technical friend of the writer came to him and asked if the radio vibrations in the ether generated by vacuum tubes might not have caused the disastrous earth vibrations which had just rocked Tokyo into a mass of ruins. He thought they might, and his question called for a serious answer. The writer told him that if there did exist any intimate relationship between the two forms of vibration, the degree of that relationship was still one of the unsolved problems of the universe; but that there was a possibility of using the vibrations generated by the vacuum tube to detect and measure the intensity of any earth tremors which might occur, and that with an extreme degree of sensibility. That is, vacuum tubes may be used with seismometers to make these instruments more sensitive.

THE METHOD

Below will be described a method whereby this may be done, but before proceeding, it is well to explain how earth tremors are detected, the instruments used for their detection and measurement, and the principles upon which they operate.

A seismological instrument is any device which is used in the study of earthquakes, or in the science of seismology. A seismoscope is an instrument which enables an observer to see the effects of an earth tremor or a light quake; a seismophone is one which enables an observer to hear the effects; a seismograph is an instrument which writes down or record the effect of the quake in permanent form; a seismometer is an instrument used to measure the intensity and direction of an earth disturbance. Some seismological instruments which are in practical use combine all of these into one.

The problem of detecting an earthquake is to mount a material body, such as a massive ball of lead, in a way which will allow it to remain in a fixed position when everything around it moves. Inertia, one of the basic properties of matter, is made use of. It is not possible to make the ball of lead remain absolutely in the same position, because it must be attached to the earth in some way, and when the earth moves, the ball will move also; but by making the mechanical coupling between the earth and ball very loose, it is possible to approximate the ideal condition very closely, so that the movement of the ball is inappreciable. It is the relative movement of the earth and the ball which indicates the occurrence of an earthquake.

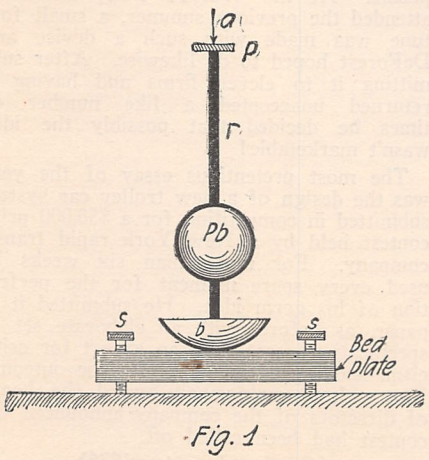
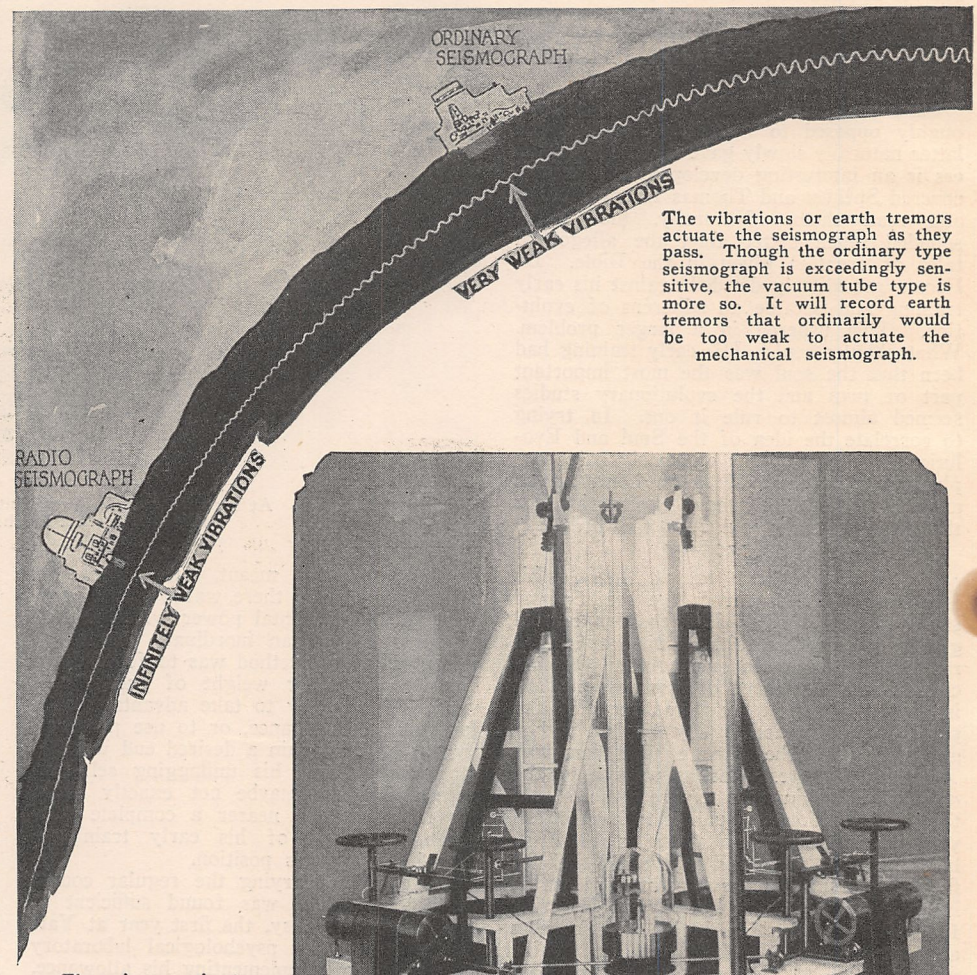
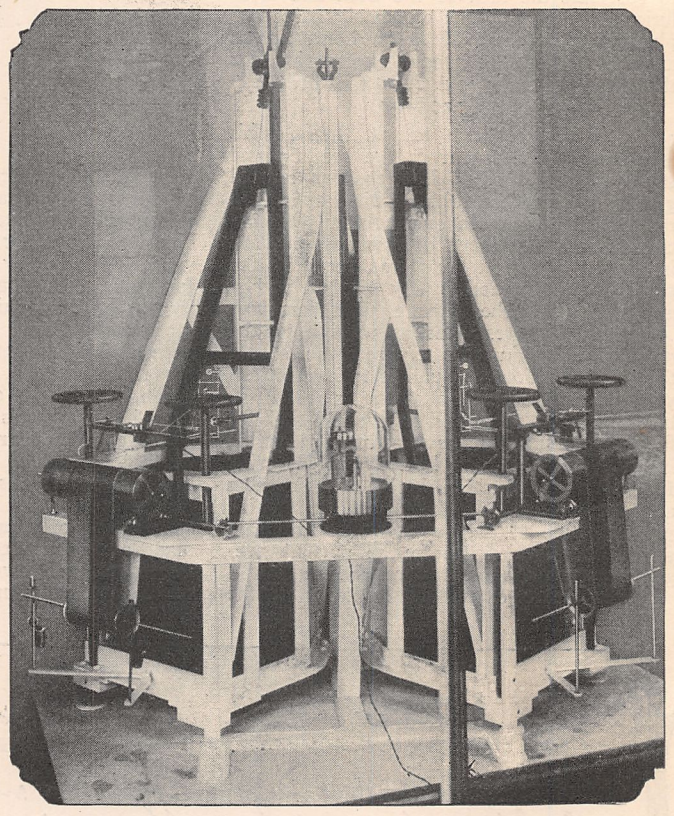


Fig. 1

A simple form of seismoscope which may be used to detect earthquakes visually.



The vibrations or earth tremors actuate the seismograph as they pass. Though the ordinary type seismograph is exceedingly sensitive, the vacuum tube type is more so. It will record earth tremors that ordinarily would be too weak to actuate the mechanical seismograph.



The seismograph at the American Museum of Natural History, New York City. Earth tremors tend to move the mechanism in the center. This slight movement is transmitted mechanically to a series of stylii which record the displacement of the earth on smoked paper. (Photo courtesy of American Museum of Natural History, N. Y.)

THE PRINCIPLE

The principle involved may be illustrated by an everyday experience in a street car. Suppose a man is standing erect in the car, with his feet close together. When the car starts suddenly, the man tends to remain in his original position because of his inertia, and consequently he falls towards the rear of the car. When the car stops suddenly, the inertia of the man keeps him going, and hence he falls forwards. If the car should turn suddenly at a curve, the man tends to continue in a straight line, and consequently he falls toward the side of the car.

The spectacle the man presents in the car is analogous to a seismoscope. But if he should rest his finger lightly on the dusty window, and allow it to trace a curve on the glass as he falls backwards or forwards, then the analogy would be a seismograph. And if he should step on some one's toe, and that one should scream, the analogy would be a seismophone.

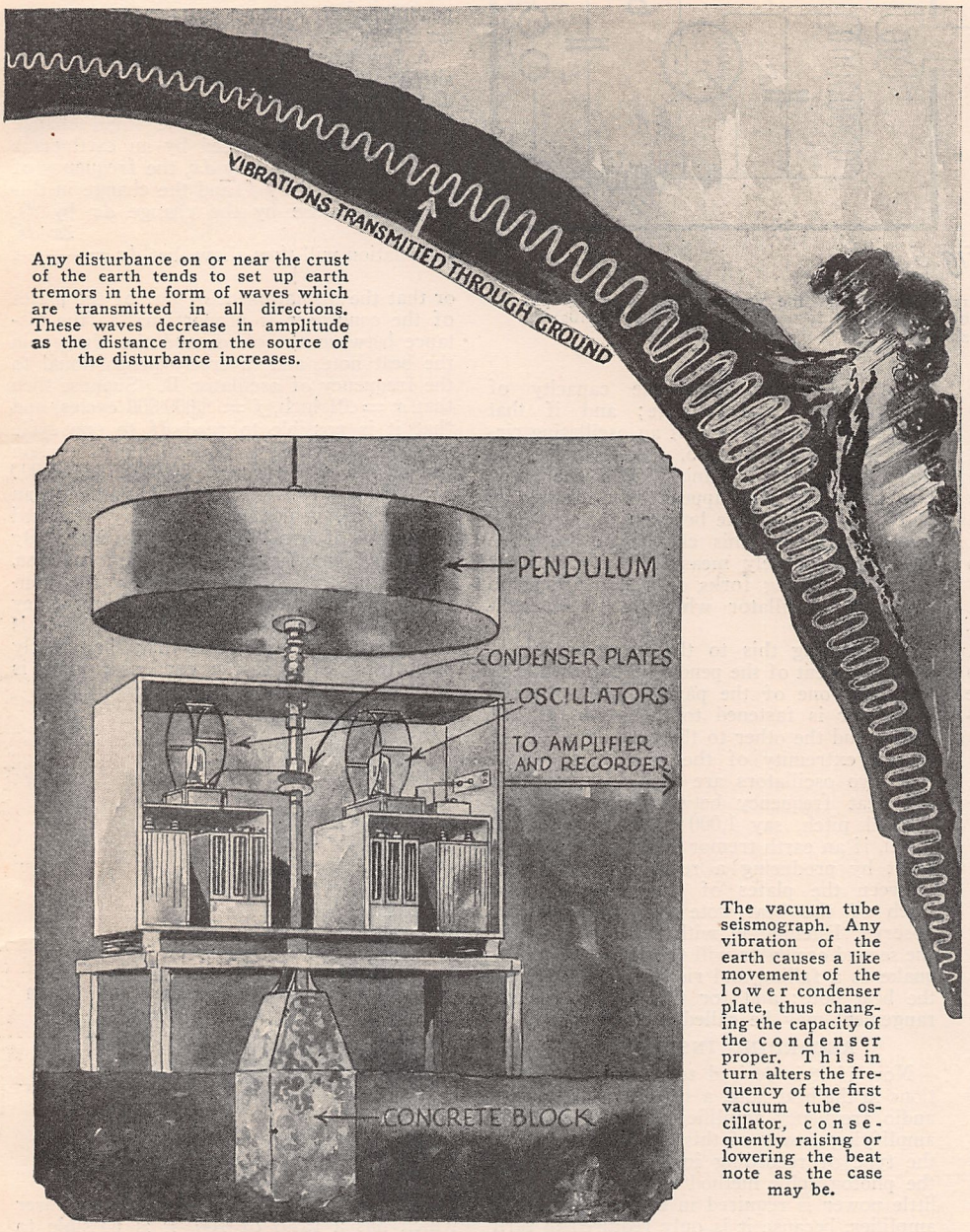
Violent earthquakes may be perceived without the aid of instruments. A person may actually feel the shock under him; a loose window pane may rattle; insecure objects may topple over; dishes in the china closet may fall and break; the plaster in the ceiling may crumble and fall to the floor. All these are indications that the ground has shaken.

Earthquakes of less violence will not give any such indications. Although they are no longer dangerous to life and property, they are still of immense scientific interest, and it is necessary to use sensitive instruments to detect and study them.

A simple seismoscope which may be used to detect earthquakes just feeble enough not to give direct indications of a disturbance is shown in Fig. 1. This instrument exaggerates the tilting effect of the ground which accompanies an earthquake wave. If the pin *a*, which has a head slightly flattened, were placed on the bed plate, it would not topple over as the earthquake disturbed the table; but when it is placed on the platform *p*, it topples over much more readily. The platform is placed at the upper end of a long rod *r*, the lower end of which is imbedded in plaster of Paris contained in a watchglass

Record Distant Earthquakes

ANDERSON, M.A.



Any disturbance on or near the crust of the earth tends to set up earth tremors in the form of waves which are transmitted in all directions. These waves decrease in amplitude as the distance from the source of the disturbance increases.

The vacuum tube seismograph. Any vibration of the earth causes a like movement of the lower condenser plate, thus changing the capacity of the condenser proper. This in turn alters the frequency of the first vacuum tube oscillator, consequently raising or lowering the beat note as the case may be.

b. A heavy lead ball *Pb* is attached to the rod to furnish the stabilizing inertia to the rod. The bed plate is levelled by means of the levelling screws *s*. As the bedplate moves under the influence of an earthquake, the rod and the platform at its upper end tilt, and the balance of the pin *a* is upset. This instrument merely indicates that an earthquake has taken place; but it may be arranged so that it will stop a watch and thereby tell when the quake took place.

But an instrument of that type is merely a curiosity and is of no value in the study of seismology. More sensitive instruments are required—instruments capable of recording and measuring the smallest earth tremors whether these be rapid or slow, of local or distant origin.

The more sensitive instruments usually take the form of some type of pendulum. Fig. 2 shows a simple type in which *h* is the lower end of a long wire or cord and *Pb* a heavy lead weight attached to it. A short, stiff rod projects from the lower side of the weight down to the point *a*. Here the short end of a lever bears upon the rod in such a way that when the pendulum swings in a plane at right angles to the paper, the lever turns about the fulcrum *f*, and the stylus *S* at the extremity of the long end moves over the surface of the cylinder *C*. This cylinder carries a strip of smoked paper upon which the stylus writes the record of the movement as the clock-driven cylinder rotates.

This vertical pendulum is free to move in any vertical plane, but it is only when it moves in a plane at right angles to the paper that the full effect of the movement is registered on the smoked paper. If it moves in the plane of the paper the movement will not be recorded at all; and if it moves in any other plane, only the component of the motion at right angles to the paper will be registered. To get the whole effect of any possible movement it is necessary to have a second lever mounted at right angles to the plane of the paper so that movements in the plane of the paper will be recorded. A separate cylinder may be used for recording the movements of the second lever, or a system of levers may be employed to transfer the two components to the same cylinder and record the two side by side. Movements occurring in any plane between the two principal planes will be shown on both the records, and the intensity and direction of the disturbance may be determined by the relative intensities of the two components.

At Catano, Italy, is a pendulum of this type which consists of a 661 pound weight suspended by a wire 82 feet long. The ratio of the multiplying lever is 12.5. This instrument is especially used to detect the tilting of the ground that accompanies slow waves originating at great distances from the point of measurement.

The horizontal type of pendulum, illustrated in Fig. 3, responds mainly to horizontal movements of the frame to which it is attached, because it can only swing about the line connecting the two pivots and move in a horizontal plane at right angles to the paper. The heavy weight *Pb* is held at some distance away from the axis of rotation by the rod *r*. A long arm *h* which carries the stylus *S* extends from the ball to the cylinder *C*. A system of multiplying levers may be inserted at *h* if it is desired to make the instrument more sensitive.

As was the case in the previous pendulum, this responds only to movements at right angles to the plane of the paper. To get movements that occur in the plane at right angles to the paper, it is necessary to mount another horizontal pendulum at right angles to the first. This may be attached to the same frame, and a system of levers may be employed to transfer the movements to the same cylinder for registry.

Tilting and lateral displacements of the ground are the most important movements that accompany earthquakes, but there are also vertical shifts. These are small and require sensitive instruments for their detection. One type of seismometer used for this purpose is shown in Fig. 4. It consists essentially of a heavy weight *Pb* suspended by a long steel spring. The weight is mounted on a lever as illustrated in order that the effect of a very long spring may be obtained with a reasonable length. By adjusting the ratio of the two arms of the lever, that is, the position of the point *a* along the rod *r*, in relation to the weight of the ball and the stiffness of the spring, it is possible to adjust the pendulum so that its period of vibration is very long, an essential condition for sensitivity to slow earth movements.

In practical seismometers the weight of the ball may vary from a few ounces to a score of tons, and the length of the pendulum arm from a few inches to a hundred feet. The multiplying factors of the levers may vary from one to several hundred, and the levers may either be mechanical or optical. The method of recording the movements depends on the size and construction

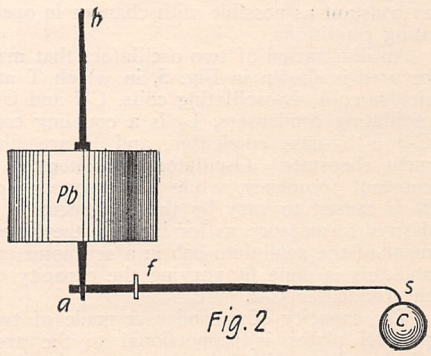


Fig. 2

A more sensitive type of seismoscope taking the form of a delicately suspended pendulum.

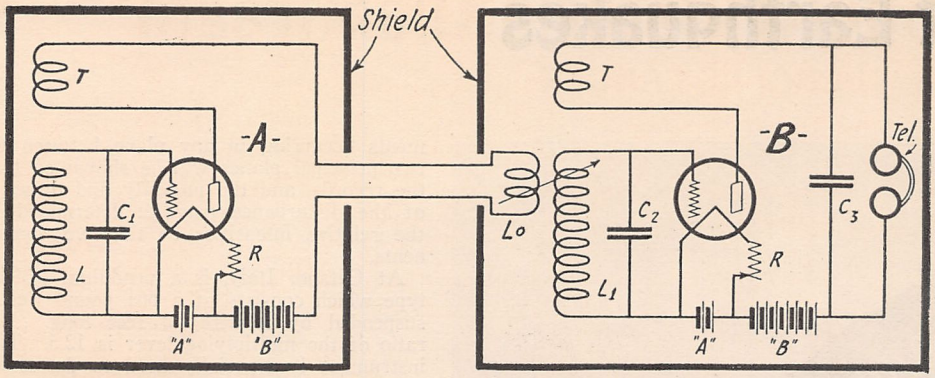


Fig. 5

Schematic diagram of the two oscillator circuits composing the vacuum tube seismograph. Oscillator A is coupled to oscillator B by the coil L_0. It is necessary that both oscillators be shielded.

of the seismometer. In some of the more rugged instruments pen and ink are used to write on a strip of paper, or a metal stylus is used to trace the movements on smoked paper. When optical levers are used to magnify the movements of the pendulum bob, a beam of light is employed to make the record on a strip of photographic film. This method is used particularly with small instruments of delicate construction.

It is in connection with the detection and measurement of the movements of the pendulum bob with respect to the earth-attached frame that the vacuum tube may be used to good advantage in seismological work. The problem is to detect a very small displacement and to measure the minute distance moved.

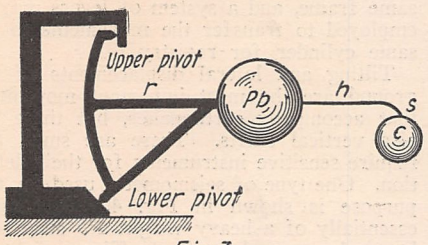


Fig. 3

A horizontal pendulum seismoscope. Note the delicate pivoting system employed.

CONDENSER MICROMETER

Perhaps the most sensitive instrument yet devised for measuring infinitesimal distances is Prof. Whiddington's vacuum tube ultra-micrometer. This instrument consists of two very high frequency oscillators which are loosely coupled to each other and adjusted so that there is an audible beat between the frequencies of the two. The oscillators are carefully shielded from all outside disturbances which might affect the frequencies; and they are also shielded from each other except for the intentional coupling necessary to produce the beats. Their construction and design are such that the frequencies remain as constant as possible with changes in operating conditions.

An illustration of two oscillators that may be used is shown in Fig. 5, in which T are tickler coils, L oscillating coils, C-1 and C-2 oscillating condensers, L_0 is a coupling coil, C-3 a by-pass condenser, and R are filament rheostats. Oscillator A is kept at a constant frequency, while the frequency of B is caused to vary by the movement it is desired to measure, as for instance the movement of the pendulum bob in a seismometer; and this is done by varying the capacity of the condenser C-2.

The capacity of a condenser made of two parallel plates is proportional to the area of the plates and inversely proportional to the distance between them. Therefore if one of the plates moves towards or away from the other plate, the capacity of the condenser will change; and if that condenser forms a part of an oscillating circuit, as C-2 in Fig. 5, the frequency of the oscillator will change. This change in the frequency will appear as a change in pitch in the beat note between the two high frequencies, and this change in the pitch may be accurately measured by comparing it against tuning forks or a standard audio frequency oscillator which has been calibrated.

In applying this to the measurement of the movement of the pendulum bob of a seismometer, one of the parallel plates of the condenser is fastened to the earth-attached frame and the other to the pendulum bob, or to the extremity of the magnifying lever. The two oscillators are then adjusted until the beat frequency between them has the desired pitch, say 1,000 cycles per second. Then, if an earth tremor disturbs the adjustment by producing a relative displacement between the plates of the condenser, the pitch of the beat note will change. An observer listening in with the telephones in the second oscillator will then hear the earthquake as a falling and rising in the pitch of the beat note; and for this reason the arrangement may be called a seismophone.

RECORDING INSTRUMENT

Now if it is desired to record the variations in the beat note, a specially constructed audio frequency amplifier is required. The amplifying power of this circuit depends on the type of recording instrument used. If the photographic method is to be used, very little power is required in the output of the amplifier, because it is only required to turn a tiny mirror, against which a beam of light is directed. But if the other forms of recording mentioned above are to be used, somewhat greater power is needed.

One requirement of the amplifier is that the current in the output be proportional to the frequency of the beat current impressed on it over a fairly wide range of frequencies about the standard selected. For instance, if 1,000 cycles per second be chosen as the standard, or steady state beat frequency, the current in the output of the amplifier should be proportional to the frequency between 500 and 1,500 cycles per second. To bring this about it is necessary to employ a special filter, or corrective network, in the circuit, to suppress the current at one end of the given band and amplify it at the other. This will cause the displacement of the stylus or the beam of light to be proportional to the change in the beat note, and consequently to the displacement of the pendulum bob with respect to the seismometer frame.

A few words may be said about the sensitivity of this arrangement. Suppose the distance between the two plates of condenser C-2 is represented by x, the small change in this distance produced by an earthquake or other disturbance by dx, the frequency of the oscillator B by f, and the change in this frequency cause by the change dx by df. Calculation will then show that $dx = \frac{2x\ df}{f}$, or that the displacement of one of the plates of the condenser is proportional to the distance between the plates and the change in the beat note, and inversely proportional to the frequency of oscillator B. Suppose then that $x = .01$ inch, $f = 5{,}000{,}000$ cycles, and that it is possible to read df to one cycle per second, which is possible under certain conditions. Then $dx = 2X.01X1/5{,}000{,}000 = 4X10\text{-}9$ inch; *i.e.*, four billionths of an inch. Prof. Whiddington actually measured a distance of five billionths of an inch. By increasing the frequency of the oscillator, decreasing the distance between the condenser plates, and increasing the accuracy with which the change in the beat note is read, the above sensitivity may be greatly increased. Then if the condenser plate is placed at the end of a multiplying lever which has a ratio of 100, it is possible to detect a movement of the earth of less than five hundred billionths of an inch, or .000,000,000,05 inch.

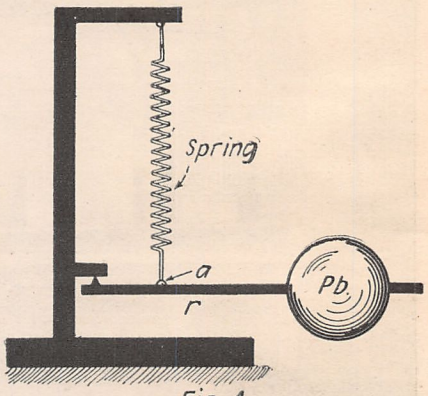


Fig. 4

Another arrangement wherein advantage is taken of spring suspension and single pivoting.

Of course, any attempt to attain such sensitivity would be accompanied with enormous difficulties, mechanical, electrical, and thermal. There would be spurious mechanical vibrations, the electrical oscillators would not remain constant for any length of time, and there would be changes in the distance due to variations in the temperature. But for practical purposes such sensitivity would not be required, and most of the sources of error could be eliminated or compensated for.

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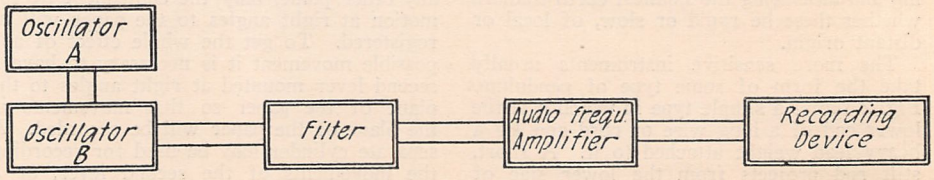


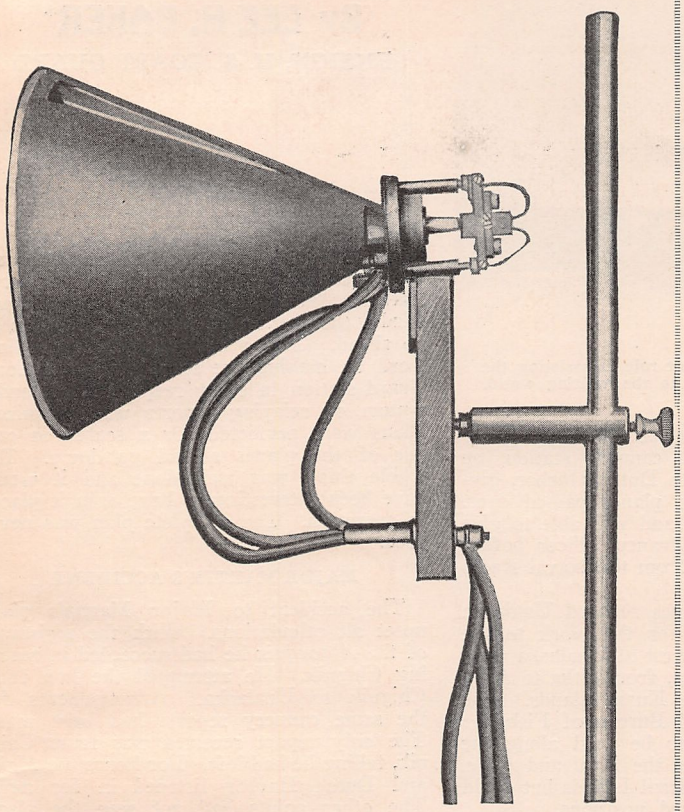
Fig. 6

Complete layout of the vacuum tube seismograph. The beat note produced by oscillators A-B passes through a filter to an audio frequency amplifier where it is built up sufficiently to actuate the recorder.

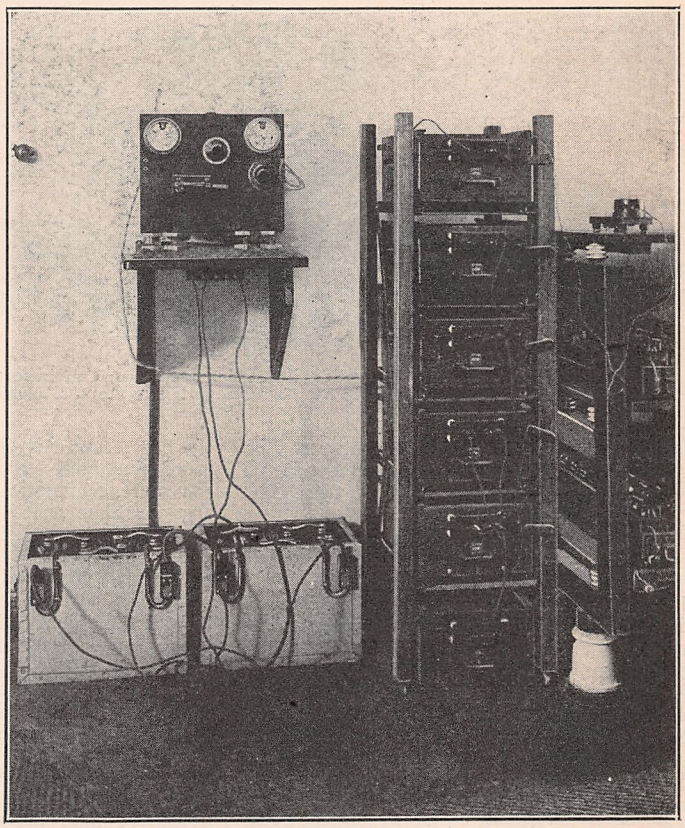
The Microphone Without a Diaphragm

By NICHOLAS LANGER

A new type of microphone functioning on an entirely different principle than the usual form. Its construction is, in a manner, similar to the vacuum tube in that it has a filament and a plate, though they are exposed to the air.



A photo of the Kathodophon. No diaphragm is utilized, advantage being taken of the phenomenon that air becomes a conductor in the proximity of an incandescent element.



The capacity and resistance coupled speech amplifiers used in conjunction with the Kathodophon for stepping up the weak voice currents, in a German broadcast station.

MOST difficulties of constructing a microphone capable of converting sounds of all frequencies with equal exactness are caused by the complicated properties of diaphragms on which nearly all modern microphones depend for their operation. For the investigator there remained therefore two possibilities only in the way of improvement, either to make a careful study of the properties of diaphragms, and to provide some special compensation for their imperfections, or to dispense with the diaphragm altogether. The latter way appeared to be the more practical one. There exists very little doubt that the perfect microphone must be looked for in this direction.

Since the sound waves have their actual existence in the air the simplest way to construct a microphone without a diaphragm is to make the air itself a conductor between the electrodes and to utilize the resistance changes of this air path influenced by the sound waves. A microphone working on this principle is the Glow Discharge Microphone of Dr. Phillips Thomas, which consists of a small electric discharge between two electrodes separated a fraction of an inch from each other upon which the sound waves impine.

Another interesting microphone of this class was invented some years ago (1919) in Germany by Messrs. H. Vogt, Dr. Jo Engl and I. Masolle for the purposes of speaking motion picture, which, with the advent of German broadcasting, has been adopted by the well-known firm C. Lorenz, A. G., and developed to a broadcast microphone called the "Kathodophon" because it utilizes the phenomenon that air becomes a conductor in the proximity of an incandescent cathode.

The Kathodophon (photo) consists essentially of a small perforated metal tube representing the anode and of a pin made of a fireproof material, the end of which is made flat like a chisel. There is a groove in the flat surface. Into this small groove a thin platinum wire spiral made incandescent by a battery is placed, the platinum wire and its neighborhood being coated with a special oxide. There is a potential of 500 volts placed between the cathode (pin)

(*Continued on page* 798)

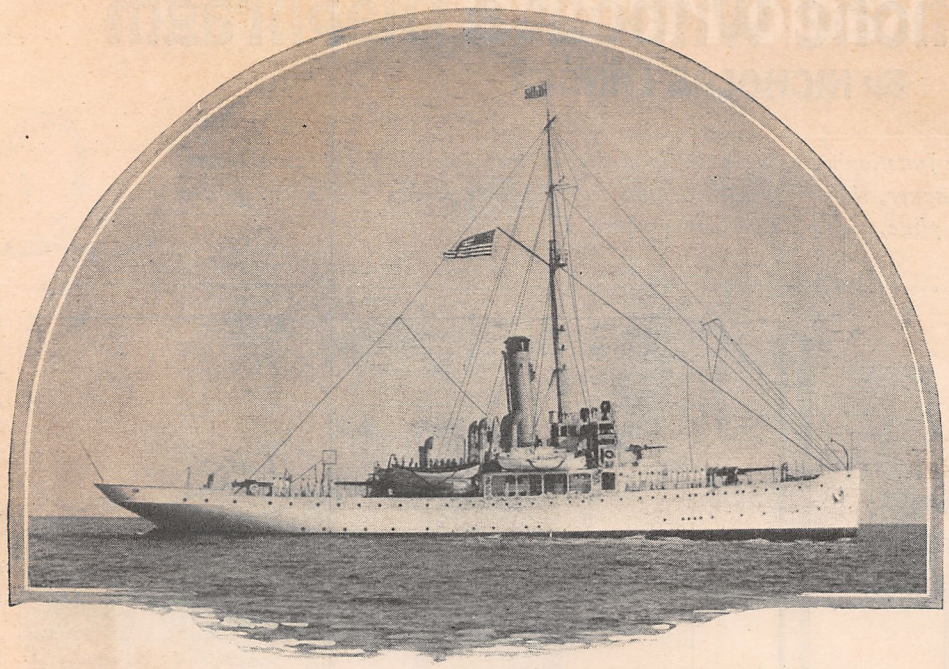
400,000 COPIES OF "RADIO NEWS"

WITH this issue, RADIO NEWS breaks all records of any radio publication. It also eclipses RADIO NEWS' former high record. Of the present issue 400,000 copies have been printed and circulated. This issue contains 240 pages and covers. There are a total of 281 columns of reading matter in the magazine, the rest of the issue comprising the advertising section.

This number is the largest in point of size, in point of text, in point of advertising and in point of circulation that has ever been printed by any radio publication, without exception.

In order to print this issue it required 530,000 pounds of white paper. If stacked on top of each other the 400,000 copies of this issue would be sufficient to reach 12,500 feet into the sky, an equivalent to the total height of 16 Woolworth Buildings placed on top of each other.

If all the copies were laid end to end in a single row, they would reach from New York to Allentown, Pa., a distance of 75 miles. It took 13 freight cars to transport the paper alone.—AND RADIO IS YOUNG YET. If RADIO NEWS has done all this in five years, what will it do during the next ten years?



The United States Coast Guard Cutter Haida which played such an important role in assisting the round the world flyers and despatching all news pertaining to the advent to the waiting world.

How the Navy Radio Helped the World Flyers

By LEE H. BAKER*
ENSIGN, U. S. COAST GUARD

IN an official announcement on the World Flight the war department stated the purpose of the flight in these few but sufficient words:

"To demonstrate the feasibility with which aerial communication may be established between the various continents and to obtain desired information concerning the operation of present type aircraft in various climates of the world."

An Army officer, in close contact with the flight, has stated that one of the greatest lessons of the flight has been learned upon communication. If the Pacific is to be crossed as a regular business it is essential that better communication be established along the Aleutian Islands. Between Dutch Harbor Naval Radio Station and Japan there is not a single radio station.

Radio was imperative and vital to the success of the flight. There were three principal reasons:

First, the planes were hopping from three to seven hundred miles on each jump. It was necessary to know the weather conditions along the line of flight. These conditions had to be known early in the morning so that the flight could start as soon as possible.

Second, if one plane fell during a hop the other planes were to proceed to the nearest radio station and drop a note telling about the accident. This made it possible to send assistance within a very short time.

Third, publicity. The flight would be of little value if the people of the United States were not informed of its progress. This news was wanted at once by all the various news organizations of the country. Radio was the means of getting the news out.

These three reasons caused the radio work in connection with the World Flight to assume extraordinary proportions. Most of the radio work through the Aleutian Islands was done by the Coast Guard Cutter *Haida*. The traffic reached its height between April 18 and May 18.

PLANS

April 18 found the *Haida* at Unalaska. Three of the planes were at Chignik. Major Martin had gone down at Kanatak while en route from Seward to Chignik. The *Algonquin* was assisting him. The other planes were expected to proceed to Unalaska the first favorable weather.

Three planes hopped off from Chignik for Unalaska on April 19. Arrangements made by the Army Air Service Advance Officer were excellent. Each cannery station, on the route, sent notice to Dutch Harbor, giving the time that the planes passed over. The *Haida* listened in and was able to give each report to the Advance Officer before he received the word from the Naval Radio Station.

When the three planes reached Unalaska plans were discussed for the work to the westward. The hops west of Unalaska were from Unalaska to Atka, from Atka to Attu, and from Attu to the Kuril Islands. The *Haida, Algonquin,* and Bureau of Fisheries Tender *Eider,* were to be used along the hops. Two destroyers, the *Ford* and *Pope,* were stationed at the Kuril Islands but could not leave their assigned positions.

The section through the Aleutians represented the hardest part of the World Flight. Distances were carefully calculated. The cruising radius of the planes and assisting vessels was considered. The radio equipment of the vessels was estimated. Definite stations were assigned for each hop. The details were largely worked out by the Advance Officer who submitted them to the Radio Department of the *Haida* for suggestions. He evidently was pleased with our ideas as he embodied them in the plan. One of the suggestions we made was to let the Coast Guard operators do the entire work. The Air Service had secured permission for Naval Operators to be used wherever needed. They were especially to be used at the shore station. We believed our operators could handle the work and secured permission to go ahead. This permission placed the final word on making the shore station a Coast Guard station in every respect. A splendid system of relaying reports was organized. Plans were perfected for a search in case one of the planes should go down. The whole thing was well done and it would have been interesting to have seen it placed in operation. The complete plan was never used.

MAJOR MARTIN'S ACCIDENT

The accident to Major Martin's plane upset all calculations. With the assistance of the *Algonquin* he had succeeded in reaching Chignik. He attempted the hop from Chignik to Unalaska. Arrangements for the same cannery reports had been made. The only report received was from Chignik, telling he had left. For hours the *Haida* and Dutch Harbor listened in for news. The other points had not seen the plane. This meant that he had not passed the first reporting station, King Cove. The plane must have fallen between Chignik and King Cove.

The *Algonquin* was in that vicinity and at once started a search calling for assistance from the cannery vessels nearby. The *Haida,* carrying the Advance Officer, left Unalaska to assist in the search. Major Blair was left at Unalaska.

For three days the heaviest radio traffic poured in and out of the *Haida.* False reports and reports containing no news, directions, orders, and suggestions for a better

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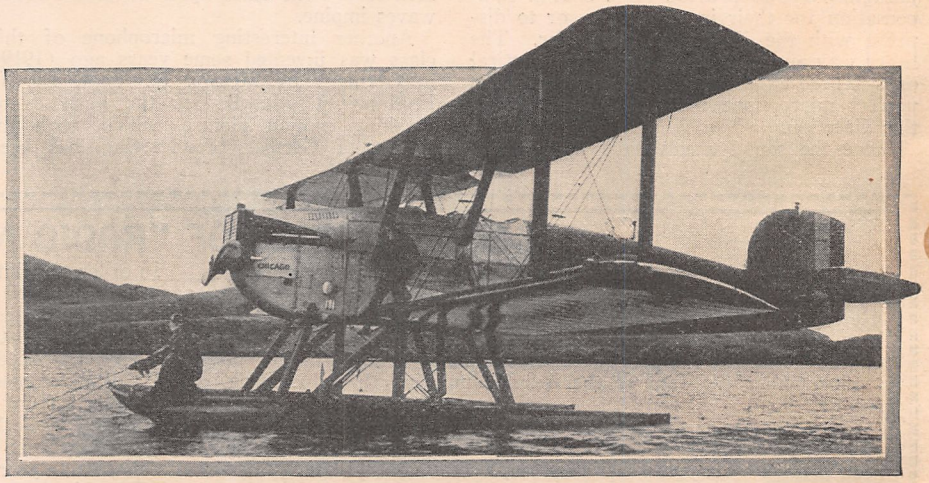
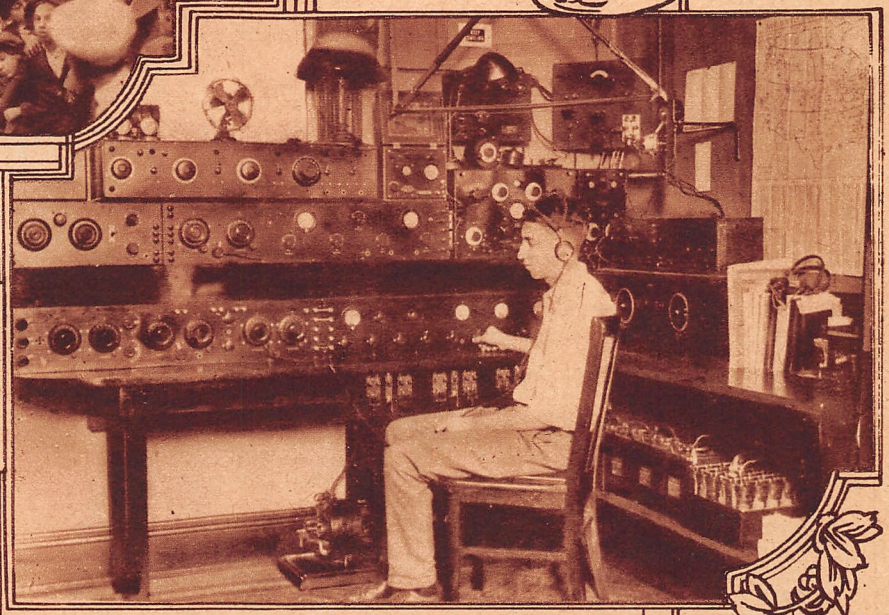


The plane Chicago, one of the mechanical birds of that memorable group which circled the globe under the pilotage of courageous and experienced army aviators.

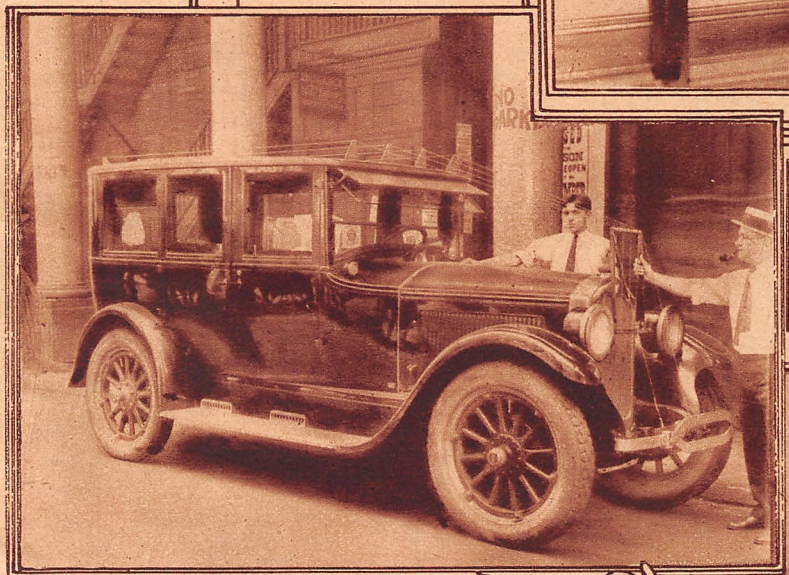
Radio Officer, Coast Guard Cutter Haida.

Radio Pictorial

Left: A special motor car equipped with radio apparatus going through the streets of New York broadcasting music is the latest. This special radio motor car left Chicago last April and is touring the country giving street demonstrations. The photo shows children listening in on radio music by the use of 20 sets of ear phones and a loud speaker. ©Kadel & Herbert.



Right: Few radio enthusiasts are able to boast of such a complete assortment of radio receivers as adorns the radio room of Peter Testan, Jr., of 2123 Troy Avenue, Brooklyn, N. Y. Some of the outfits in evidence are Super-Heterodynes of several types, Neutrodynes and simple regenerative receivers. A switching arrangement makes it possible to instantly use any of the sets pictured. © Fotograms, N. Y.

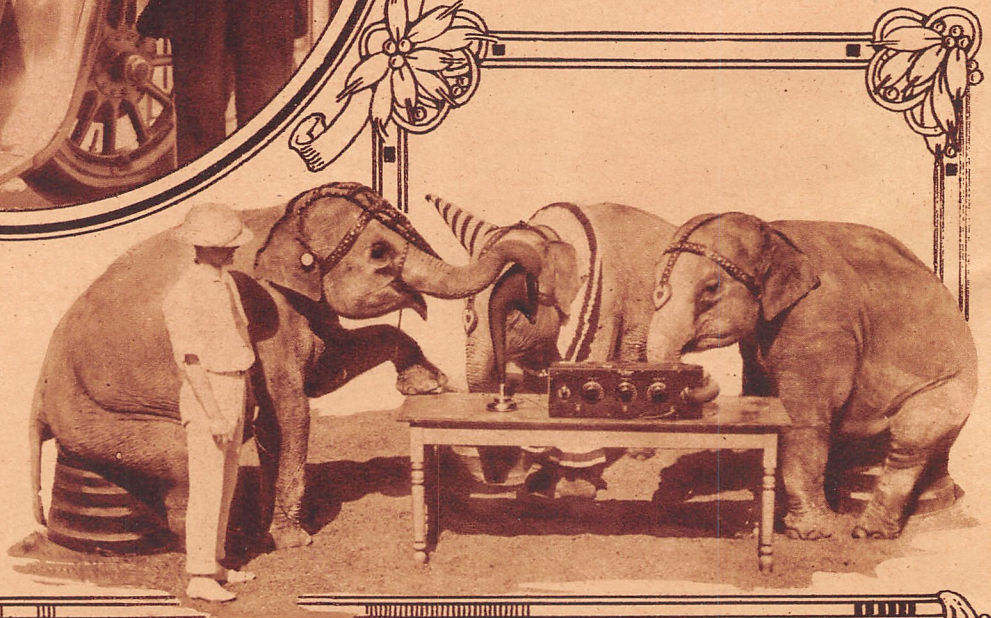


Left: A new type of radio car made its appearance at the Democratic Convention. It was a magnificent limousine all fitted with an elaborate antenna system on the outside, and sensitive radio receiving apparatus inside. It was used every day in the vicinity of Madison Square Garden to permit great crowds on the outside of the Garden to hear everything going on at the Convention. © Kadel & Herbert.

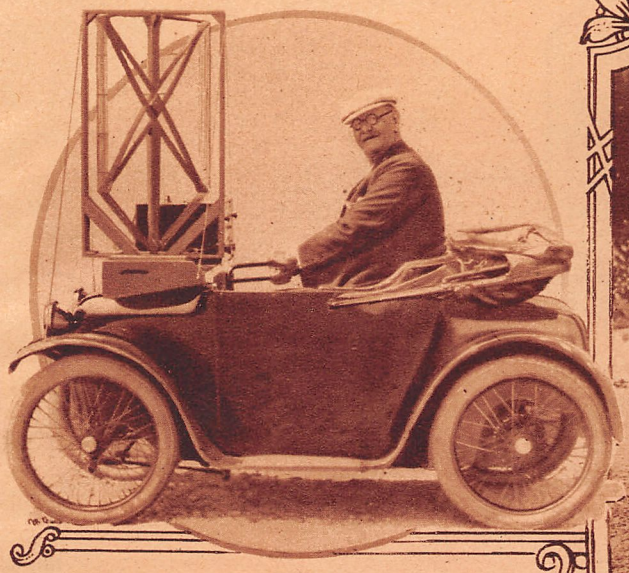
Right: Something new in radio sets. Gertrude Dalton and her unique broadcast receiver which requires no aerial, no ground and no "A" or "B" batteries. It works directly from the light socket. The loud speaker is contained in the right hand section of the cabinet. It is a three tube set and measures only 7 by 18 inches. © Fotograms, N. Y.

Above: "Fighting Bob" LaFollette of Wisconsin, Independent Progressive nominee for president, seen rehearsing parts of his speech before the newly-invented talking moving picture machine which he will use during his campaign. This apparatus was invented by Dr. Lee DeForest, the originator of the three element vacuum tube. The pictures and the voice are recorded on the same film. © Henry Miller News Picture Service.

Left: President Calvin Coolidge examining a new type of portable radio receiver especially adaptable to automobiles. This receiver can be used while the car is in motion. © Henry Miller News Service.

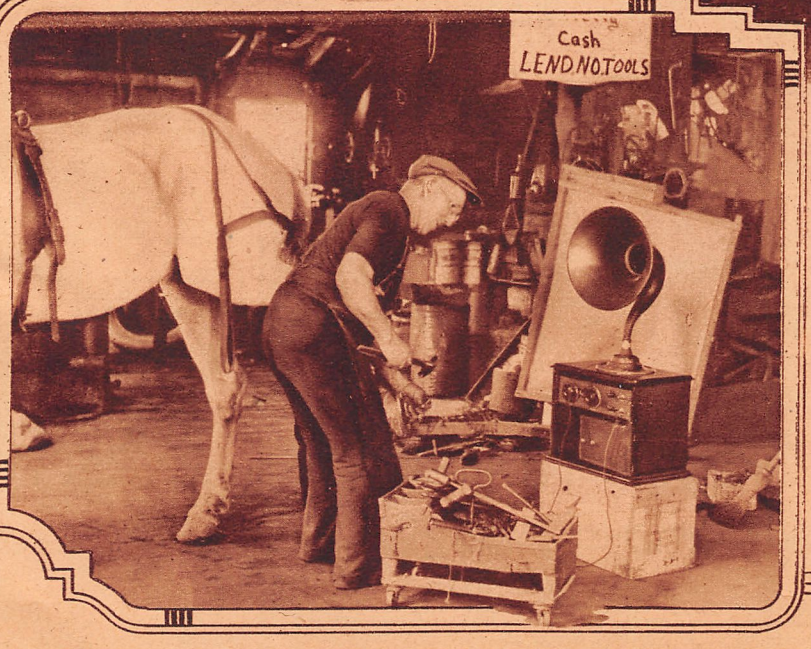


Right: This interesting picture shows three elephants very much taken with a radio set. Mrs. Jumbo, on the left, is trying to determine from where the sounds come, with the aid of her trunk, while Mr. Jumbo, on the right, insists on turning on full power. © Kadel & Herbert.



Above: Col. E. H. R. Green, son of the late Hetty Green, in his miniature electric drive runabout which is equipped with a sensitive radio receiving set. He uses it mostly for picking up concerts from his own broadcast station, WMAF, at Round Hills, South Dartmouth, Mass. © P. & A. Photos.

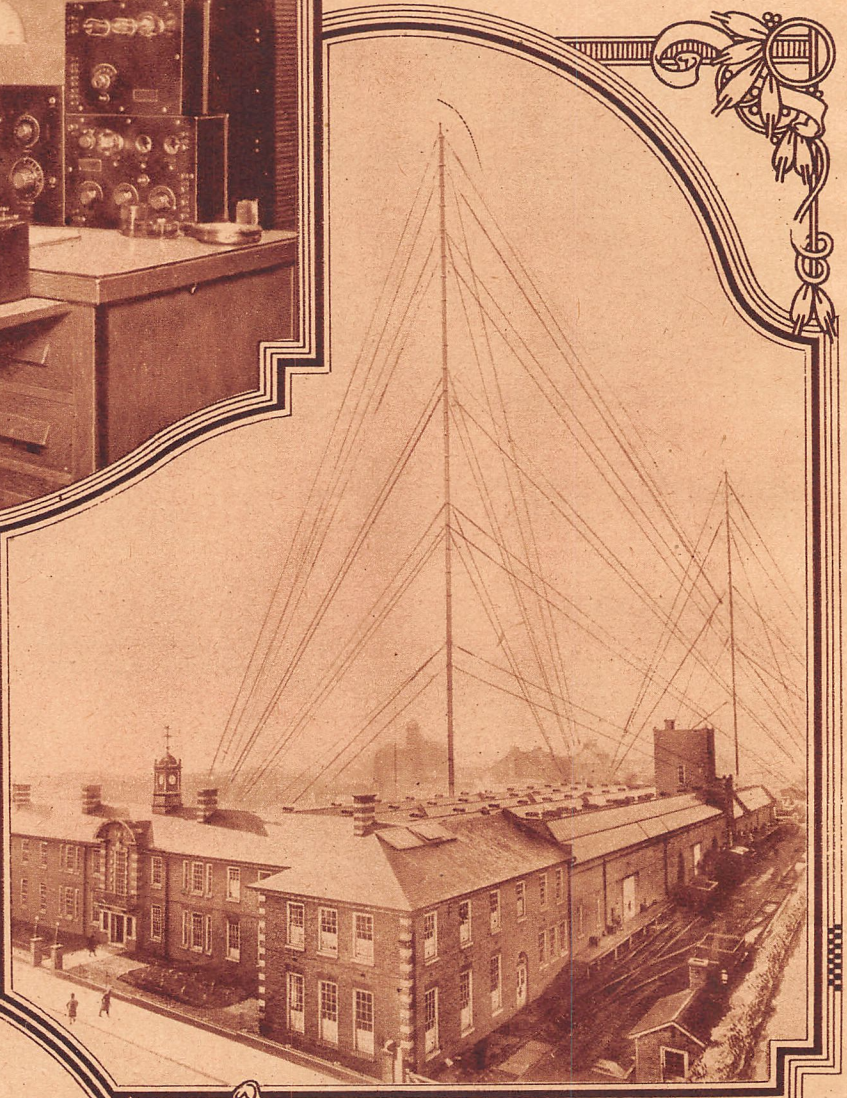
Above-right: Chief Tony Tommy, re-elected to the highest position in the Seminole Tribe to serve as chief for the next ten years, gets a bit of the white man's civilization at Fort Lauderdale, Florida. This is the first time the Florida warrior has ever listened in and he braves the camera man with his squaw and papooses. © P. & A. Photos.



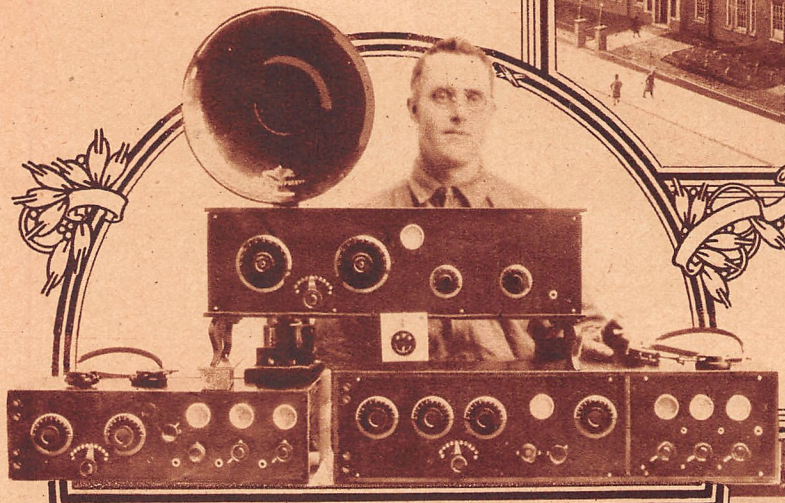
Above: Major L. O. Gardner, publisher of the magazine "Aviation," on the Mall in Central Park, New York City, Speaking to an aviator who is hovering, cloud covered, somewhere far aloft. © Wide World Photos.

Left: C. A. Weaver of Bar Harbor, Maine, the village smith, finds it much easier to do his work to the accompaniment of radio music. The tap tap tap of his hammer keeps time with the melodies. What ho! for the anvil chorus. © Fotograms.

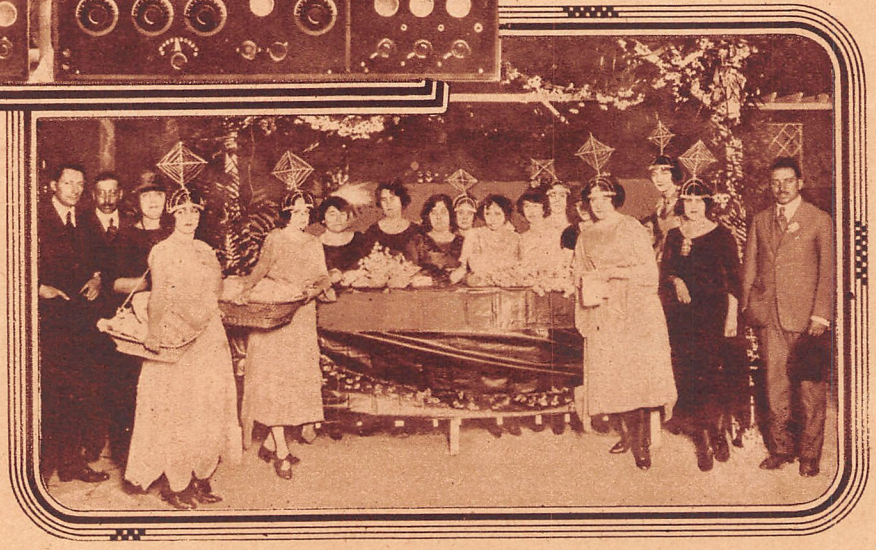
While his son was making a record-breaking flight in circling the globe by airplane for the first time in history, Jasper Smith, Commander Lowell Smith's father, sat at his radio almost constantly listening for tidings from his son. The photograph above shows the older Smith at his highly efficient radio set keeping watch on the air. © P. & A. Photos.



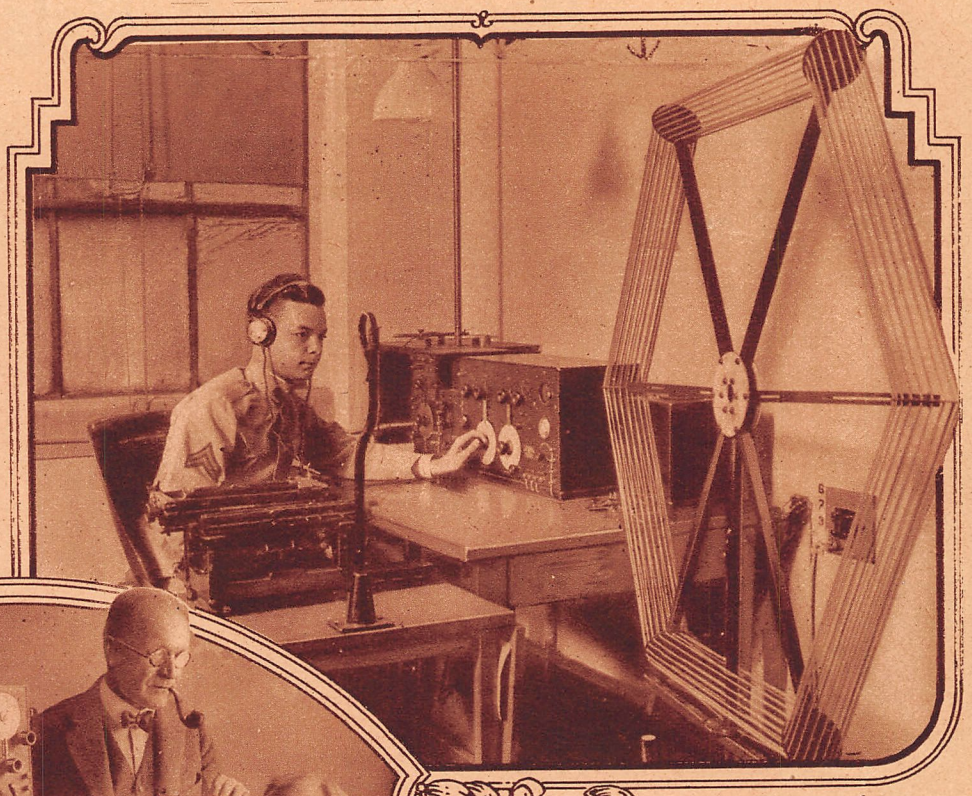
The British Broadcasting Company has erected a new high powered broadcast station at Chelmsford, England, from which they hope to carry on a number of experiments looking toward the improvement of general broadcasting. The above photograph shows the antenna system of the station towering high above the Marconi factory where it is installed.



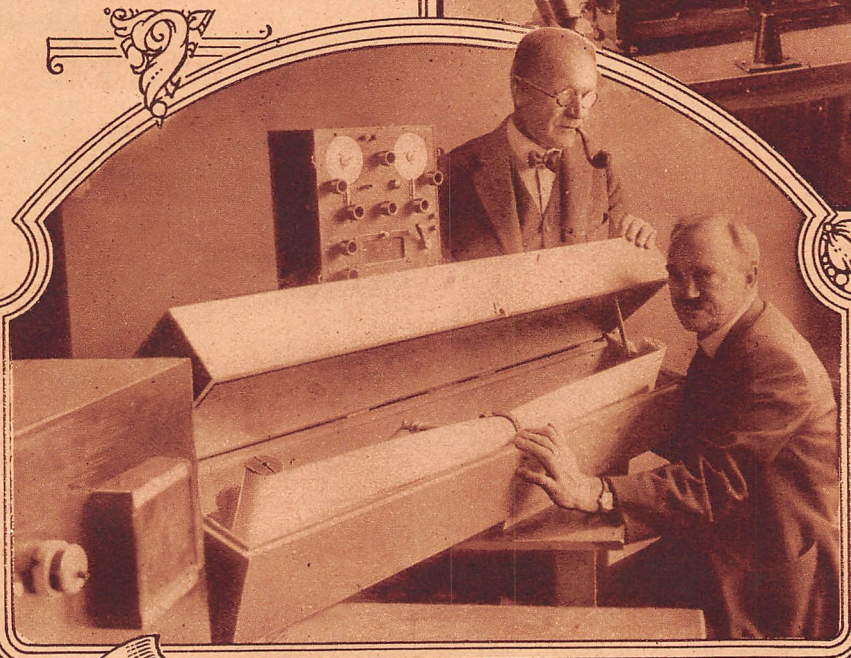
Two years ago R. M. Holm was not interested in radio, then one day having nothing better to do, he picked up a copy of RADIO NEWS at a newsstand to read going home from work. The result of this little episode, is graphically shown in the above illustration. Mr. Holm has become a radio fan and a part of his collection of apparatus may be seen in the photograph.



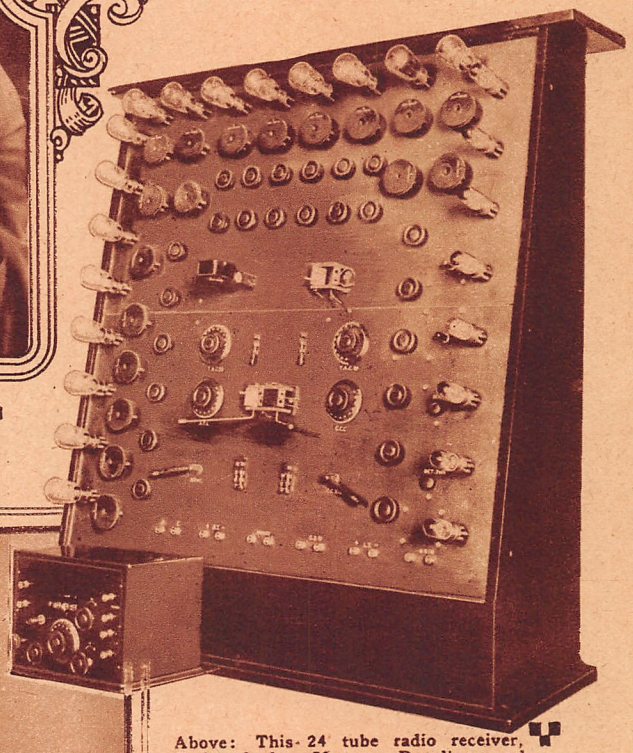
Mexico City recently enjoyed its first radio show. At the left may be seen a corner of the exposition and a number of the young lady ushers who show visitors over the various exhibits, wearing decorative loops on their heads. © The Gilliams Service, N. Y.



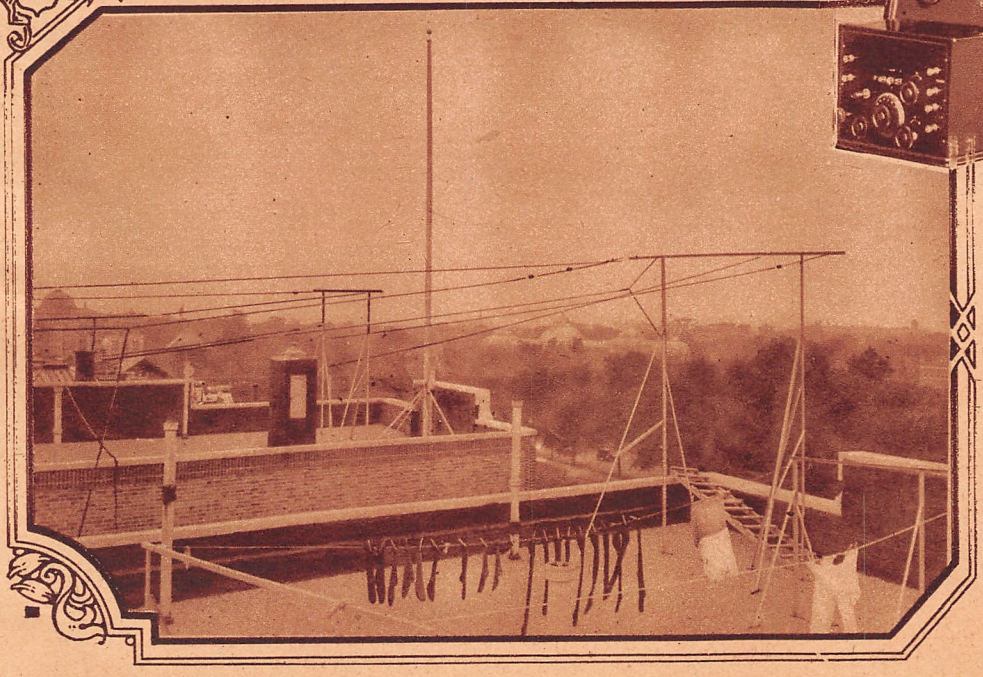
Right: Corporal John H. Sadler of the United States Signal Corps, because of his excellent record as a radio operator has been assigned temporarly to this special station which was erected for the sole purpose of attempting the reception of signals from the planet Mars. A long wave Navy receiver in conjunction with a radio frequency amplifier and a large loop aerial is being employed. The loop aerial consists of ten turns of a cable composed of twelve wires each insulated from the other and was designed by Dr. Rogers of Underground Aerial fame. © Henry Miller News Picture Service.



Above: Professor C. Francis Jenkins (right) and his new photographic recording receiving apparatus used in an attempt to catch messages sent from Mars. © Henry Miller News Picture Service.



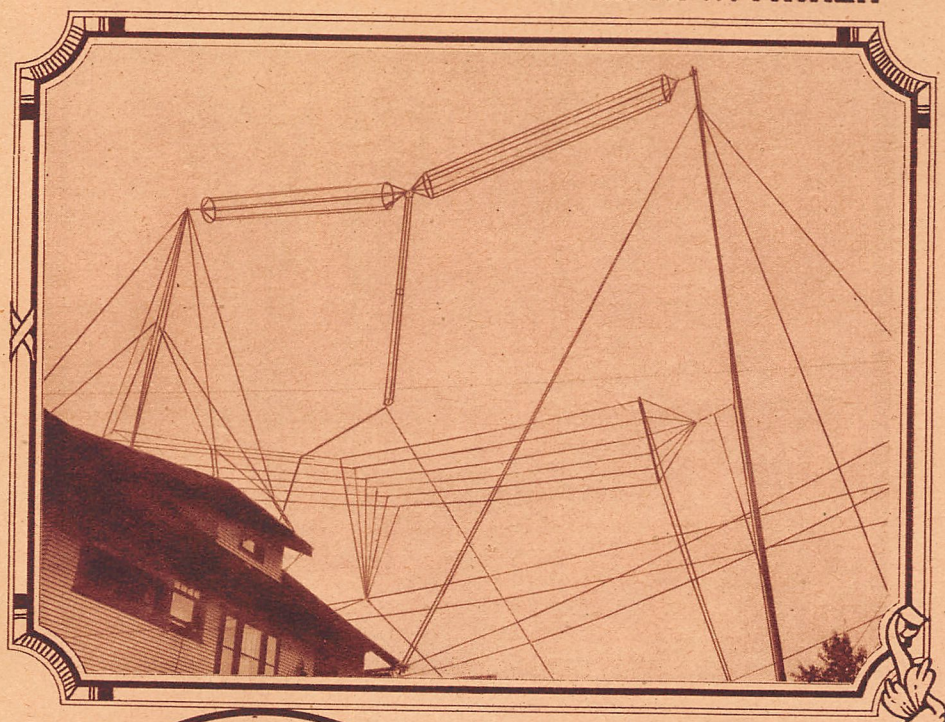
Above: This 24 tube radio receiver, designed by Messrs. Dowding and Rogers, English radio experts, was constructed for the purpose of attempting to pick up any radio signals that may be sent from the planet Mars. It measures three feet square and an ordinary two tube set is shown beside it to give an idea of size comparison. It can be lifted by two men only with difficulty. © P. & A Photos.



Left: An enterprising landlord in the Bronx, New York City has had steel supports of uniform size built on the roofs of his apartment houses for the benefit of tenents who have radio sets. A certain amount of space is allowed each tenant and all he has to do is to attach his aerial wire to the mast. The photo shows two apartments so equipped. © Kadel & Herbert.

Dangerous Aerials

By JACK W. MARER



Above: This aerial shows how a person who is cautious and mindful of life and property can construct an aerial with perfect safety to all concerned. Every wire, with the exception of three, belongs to the aerial system.

REALIZING that many lives and thousands of dollars worth of property were endangered every minute of the day because of radio aerials dangerously placed, City Electrician I. Lovett, of Omaha, Nebraska, and the Nebraska Power Company decided on a city-wide campaign to eliminate these dangerous hazards.

All radio fans were appealed to through broadcast stations and in other ways, and were requested to make sure their aerials were not placed dangerously near high voltage transmission lines.

These warnings went unheeded, and shortly following, a man was killed when he attempted to repair a dangerous aerial.

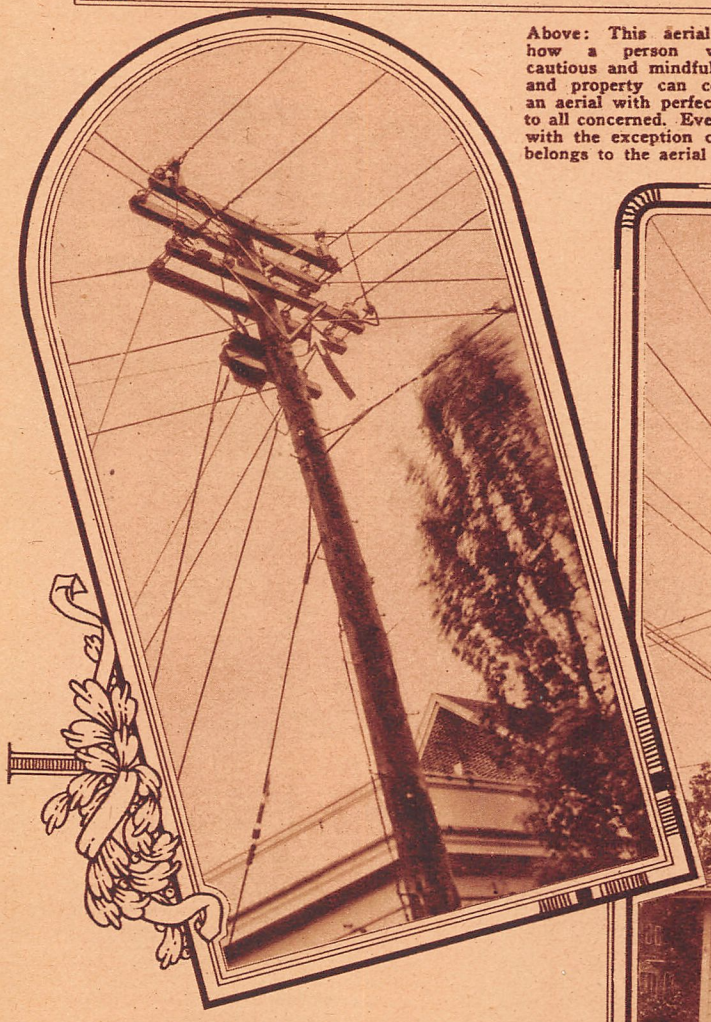
This death resulted in the decision to make a drive to wipe out the dangerous aerials. The good results were astonishing.

Omaha has a large number of radio fans because the city is centrally located and because it is the home of the large broadcast station WOAW.

Although Omaha is probably the central location with relation to radio broadcasting and receiving, it is also the center of the storm area of the United States.

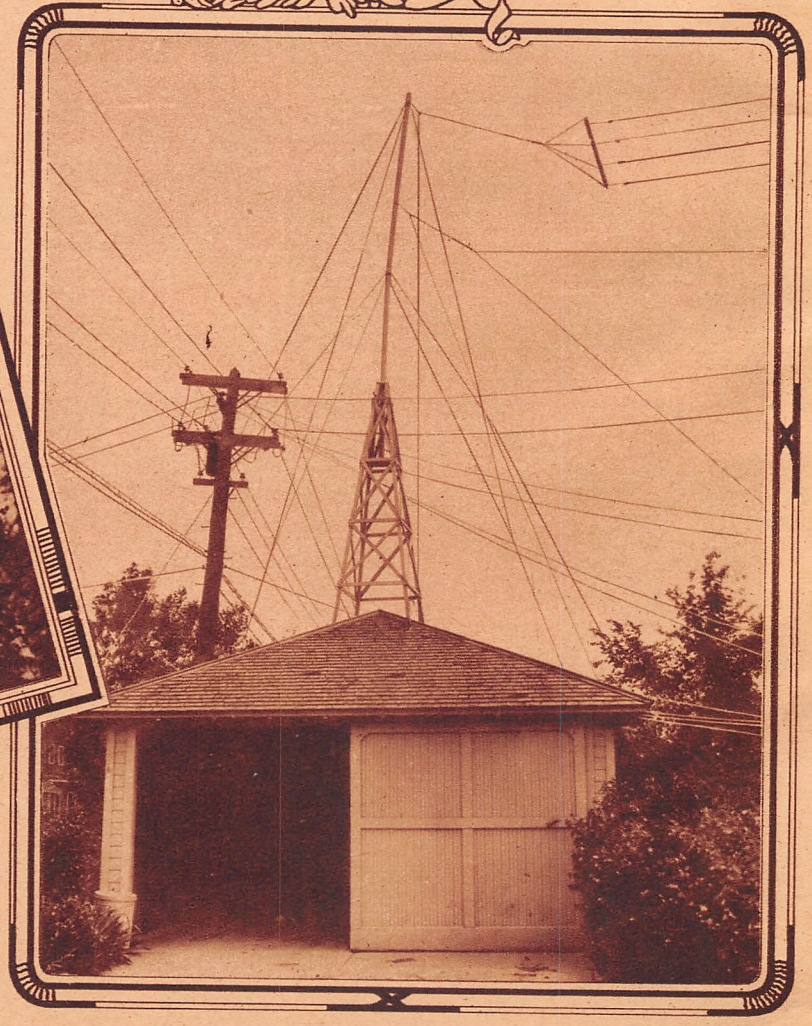
Because of these two facts a city ordinance was placed upon the statute books

(*Continued on page 742*)

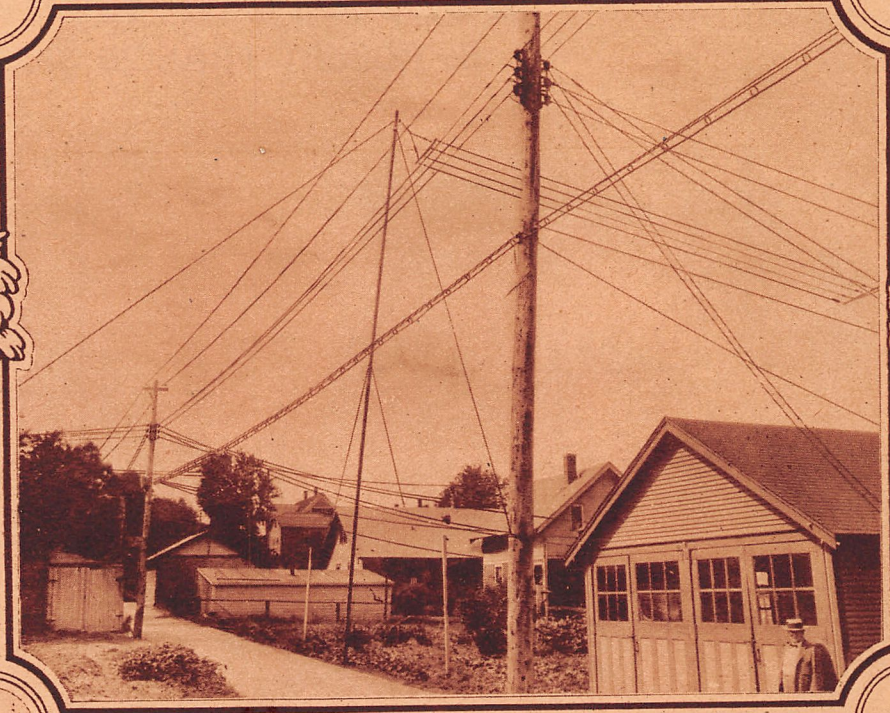


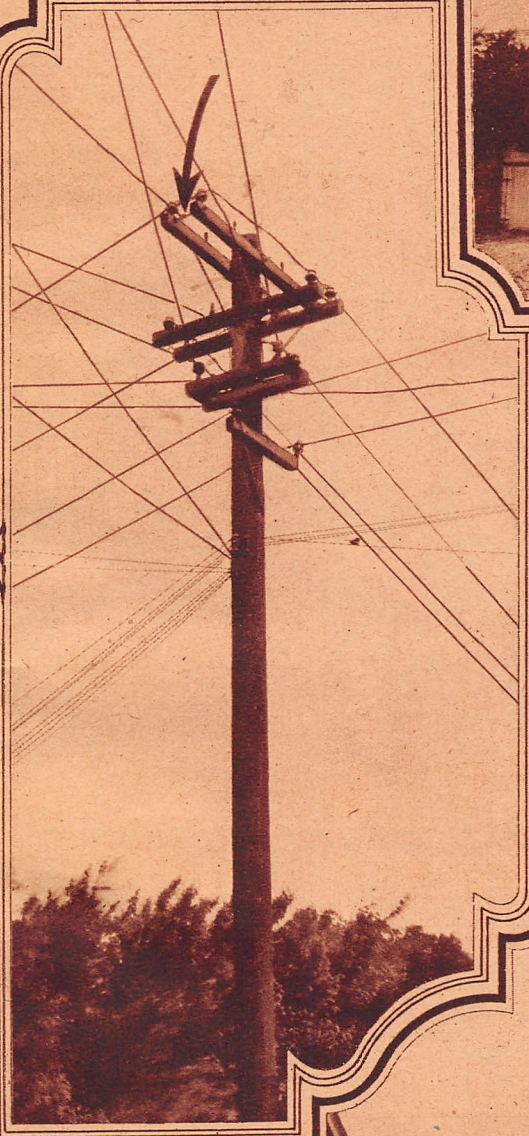
Above: As the arrow indicates, this antenna wire is wound around a cross arm brace from the pole to the cross arm. On the same arm to which the cross arm brace is attached are two 2,300 volt fuses. On the arm just above this are two wires carrying 2,300 volts each. If the high voltage wires should break, they would come in contact with the antenna wire. The insulation of the antenna would not protect it against the high voltage.

Below: This aerial runs from a tower on the roof of a house to a large tower on the garage, and is built between two service wires. The owner fastened one wire to the tower with a porcelain insulator. Constant rubbing of the wire against the structure might, under certain conditions, set fire to the garage.

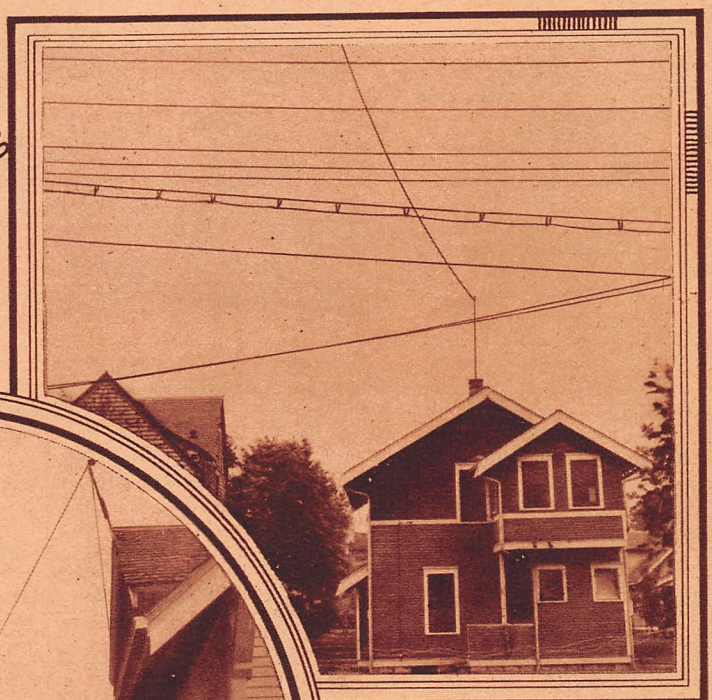


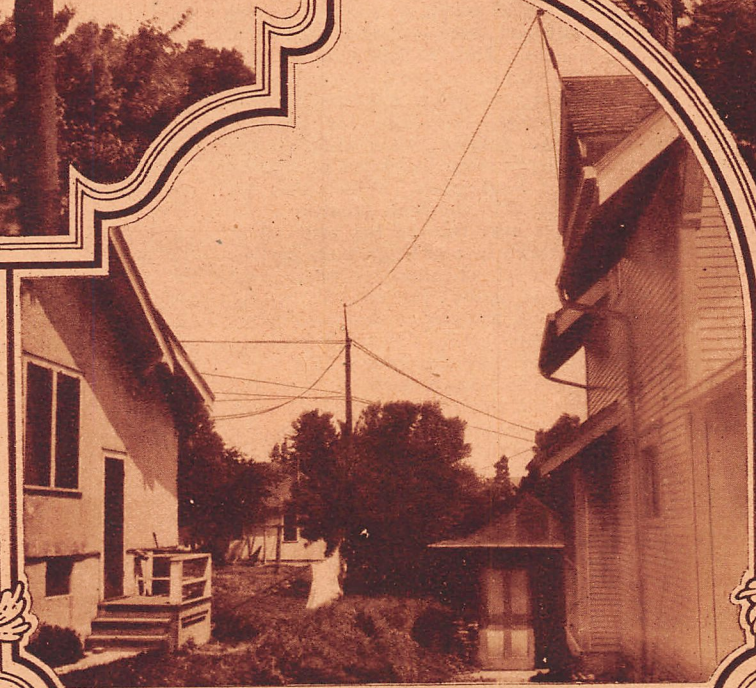
Right: This forty-foot pole is built of two pieces, end to end, of ordinary 2 x 4's and guyed with single wires. One guy wire passes over and above wires carrying 2,300 volts. The end of this guy wire is fastened to a small piece of pipe, driven into the earth. If this wire should break at the ground it would drop and come in contact with these high tension wires, which would mean death to any person coming in contact with it.





Below: This antenna wire runs from a very thin pole, fastened to the chimney of the house, to a tree in the rear yard, passing over no fewer than nine wires. The wires directly underneath the antenna wires are two high tension wires carrying 2,300 volts each.



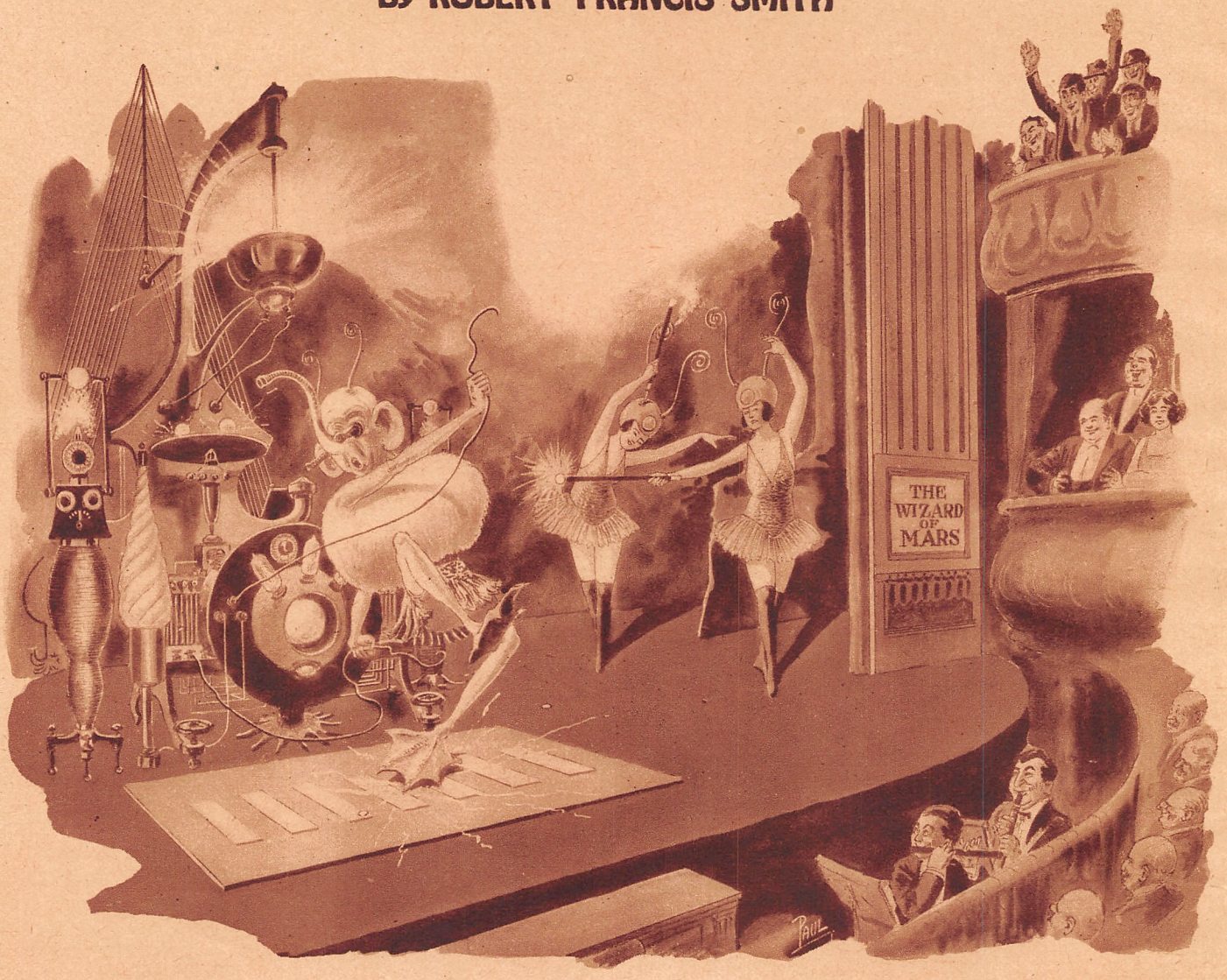


Above: This antenna wire is wrapped around a bolt connecting the two topmost cross arms on this pole. The upper wires running to the pole are two wires carrying 2300 volts each and two street light wires carrying 6,500 volts.

Left: This aerial was constructed by a boy. The antenna wire runs from a two-piece stick, nailed on the side of the house, to another two-piece stick on top of the pole in the rear alley. The stick at the house is not guyed in either direction. The stick on the pole is nailed. There are no footholds on the pole. The lad who climbed this pole did so with the risk of losing his life.

Cent From Heaven

By ROBERT FRANCIS SMITH



The Master happens to have hold of two loose wire leads, supposedly on a six-volt circuit. But the short threw in a dose of high frequency juice, and the Master gets a nice 10,000 volt jag on. He can't let go, but he can wiggle, and wiggle he does.

ONE thing can be said in favor of a radio nut—you don't have to crack it to see if it's rotten. A Radio Nut is all right in its place, but it ain't got no business to wander about indiscriminate-like. As Abe Lincoln, or maybe it was Will Rogers, once remarked: "Some people is born actors, others has histrionics pushed on 'em, but most of the mob is just plain goofs," or words to that effect; anyway, the sentiment is clear. Personally, I was born with clog shoes on, and Doris, my four-speil brake, was kidded into wearing out the boards. But The Master ain't got no excuse to offer.

The Master is a radio nut from any angle, but he's a serious nut, which kind is the only variety it's safe to annoy. Fond parents named The Master Gerard Lawson, but folks calls him Jerry, which only goes to prove how environment can counteract wealth. For The Master has so much jack he strains his wrist when he has to clip the coupons from his month's crop of gold bonds. His cash is in the hands of a board of trust-thieves which sends him a quarterly statement of how much he's made and how much he's gonna get. Thus being relieved of life's greatest puzzle, namely, When Do We Eat, Jerry devotes his time to science. Aside from that, he ain't such a bad chap. He's twenty-two, has dark patent-leather hair, spectacles to match, a skin you almost love to touch and more cuckoo ideas than a flv has cousins. Thus he has a lot of long green to spend, time to burn and conscience to spare, most of which qualities he uses while he works. He calls his joint a laboratory, but it looks like a sample room in Hades; there's more fool kinds of rigging than I can or would place. Which ain't got nothing to do with the loud squawk.

Me and the dear beloved has been idling the summer down here at Brightmere-on-the-Deep, doing a lot of things we never done before, nor will again. But now it's getting towards August, and our professional minds turns to "the new act." You see, heretofore we has always rode the circuit as a two-act, with a sweet-faced sheik to paw the tinkle-box. But this season the secretary of our treasury decides we shall give the customers a run for their money by staging a production act.

For the benefit of them what ain't initiated, a production act is one of those fancy affairs with a lot of scenery, a big cast, and occasionally a little talent. We ain't stinting ourselves; when the wife is through with the scenic artist and producer we have for our savings three silk drops, two cycloramas, half a carload of such indispensables as imitation peach trees in full bloom, full flights of stairs with arched gates at the top, and so on, not to mention a five-piece jazz band, a female blues-shouter, a specialty dancer and six chorus girls, together with a suitcase full of costumes. And of course, in a small way, ourselves. All of this ain't of no particular interest except as it hinges on later.

Well, we rehearsed in New York, commuting to Brightmere-on-the-Deep by means of The Master's airplane, he piloting us partly for friendship's sake and mostly for the chance to stick around and see a lot of the ladies of the ensemble. The Master ain't no fool, even if he is sort of one-way in respect to humor. But I sees he's got a crush on one of the girls, and knowing he's really innocent, I tips him off.

"As friend to friend," I advises, "lay offa Millicent. She's a charter member of the S. I. P."

"What do you mean?" he asks. "S. I. P.—"

"Sisters of the Itching Palm," I explains. "She's one of these two-by-four girls."

"A two-by-four girl?" he repeats, all brain cells missing fire.

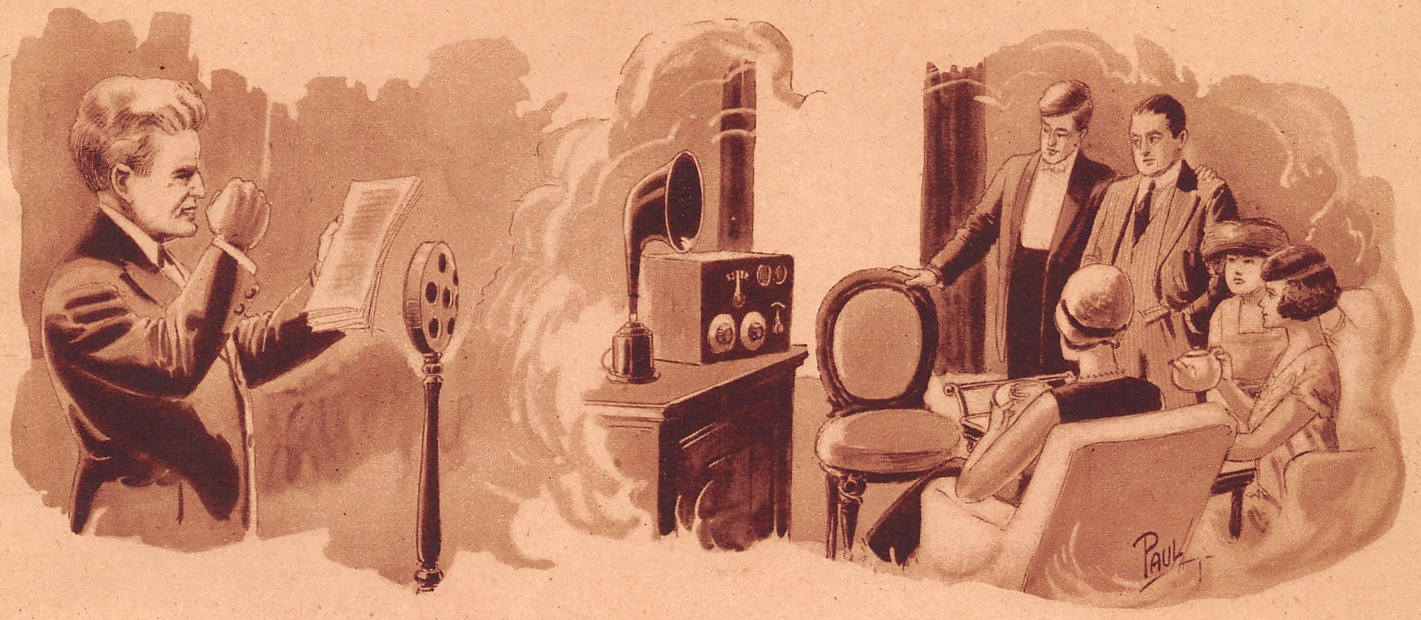
I smiles. "Yeh. Meet her at two, by four you're broke."

He don't get it, as I expected, but live and let live is my motto, so The Master stays with us. The big idea begins to crack

(*Continued on page 726*)

Radio and a New Political Era

By J. GEORGE FREDERICK



Today the political speaker does without his physical motions, puts a bit more pep into his words and holds his audience of many million citizens who, with their headphones or loud speakers give serious consideration to his words. Radio has made this possible and it is superior to the old way by far.

LOOK for a new era in American politics.

Radio will be the transforming agent.

I am not trying to throw a new bouquet at the radio field—I am speaking, as an economist and writer; I am coldly visualizing the situation as I find it.

What are the facts? First, that to a deplorable degree the foundation principle of American political life has fallen foul of modern high-speed civilization—with the result that scarcely more than 50 per cent. instead of 80 per cent. of our voters vote. The old New England "town-meeting" has been proclaimed by more than one wise political economist as the ideal political organism, because it brought voters into personal touch with candidates and issues. Personal contact of some sort is fundamental in our political functioning, because the substitutes for such personal contact are too dangerous—too full of bias; too remote to keep alive voters' interest.

We have traveled a long way, however, from the old New England town meeting, to our political harm. Progress and civilization's complexity have forced us away from it. Our cities are too big for town meetings; we have had "ward meetings" instead. We have become too busy with the high-speed business machine to have much energy left for political foregathering. Our life has become too complicated, the demand on our time too great for the old-time political methods, and so we have Tammany and kindred organizations. Those who think about our political life have been much disturbed by our tendencies to ignore political things. Just what, such people ask, are we drifting to?

Into this situation comes radio; its coming, like all big things not casting its shadow before, and causing no ripple on the political surface—until the two big national party conventions of this year.

It is doubtful if any great invention—steamboat, cotton gin, telegraph or telephone—ever made such a broad, resounding splash from one end of the country to another, as did radio in connection with politics. The full significance of the situation is not even yet clear to all. Radio practically made an old fashioned New England town-meeting out of the entire country, from lumberjack and miner to the millionaire yachtsman sitting on his deck in Newport Harbor. More significant, perhaps, even than this, was the fact that women and boys and girls sat in at this town-meeting, and got a more graphic lesson in "political science" than any of their dull text books ever afforded. The naked mechanism of party rule, of sectional prejudice, of log-rolling and political buncombe, heroism and inspiration were all exposed to the nation, precisely as it was in the olden days in Massachusetts when the farmers for miles about came, hitched their horses, talked matters over and otherwise participated.

Through radio has come something of a revival of the innate political idea of the American democratic principle, something of the old cracker-barrel spirit of argumentation and competitive zest.

The campaign leading up to election day will put radio to test for political serviceability to a degree nothing else has ever been tested; not even the newspapers or the telegraph. We have conducted politics in America in recent generations by *newspaper*, by printed word; and it has not

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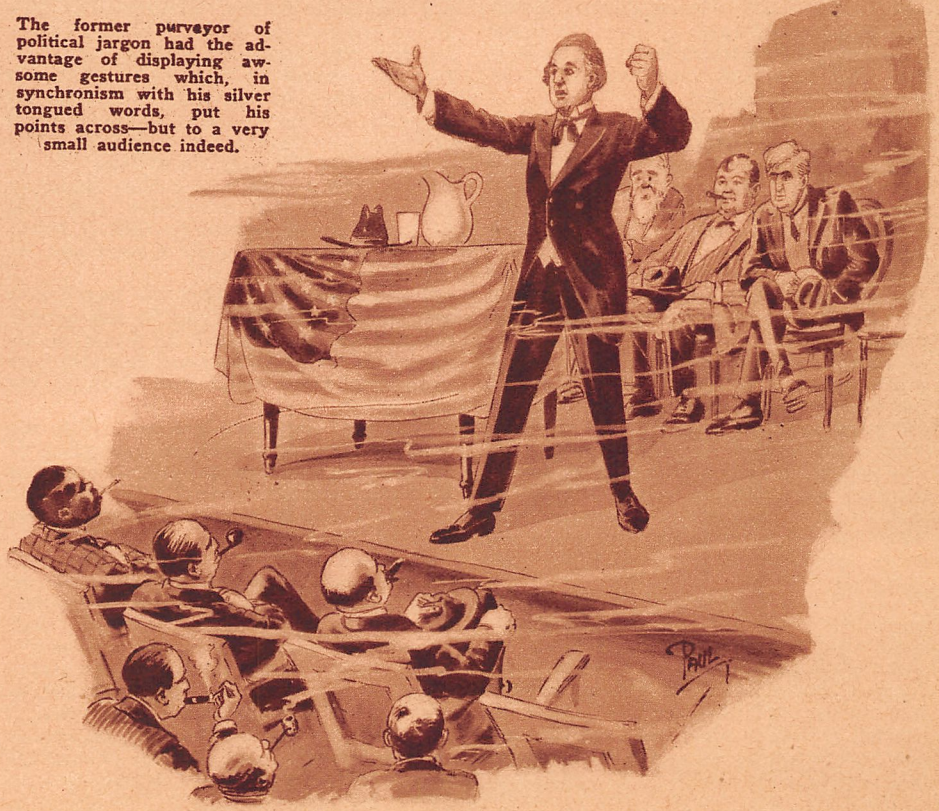
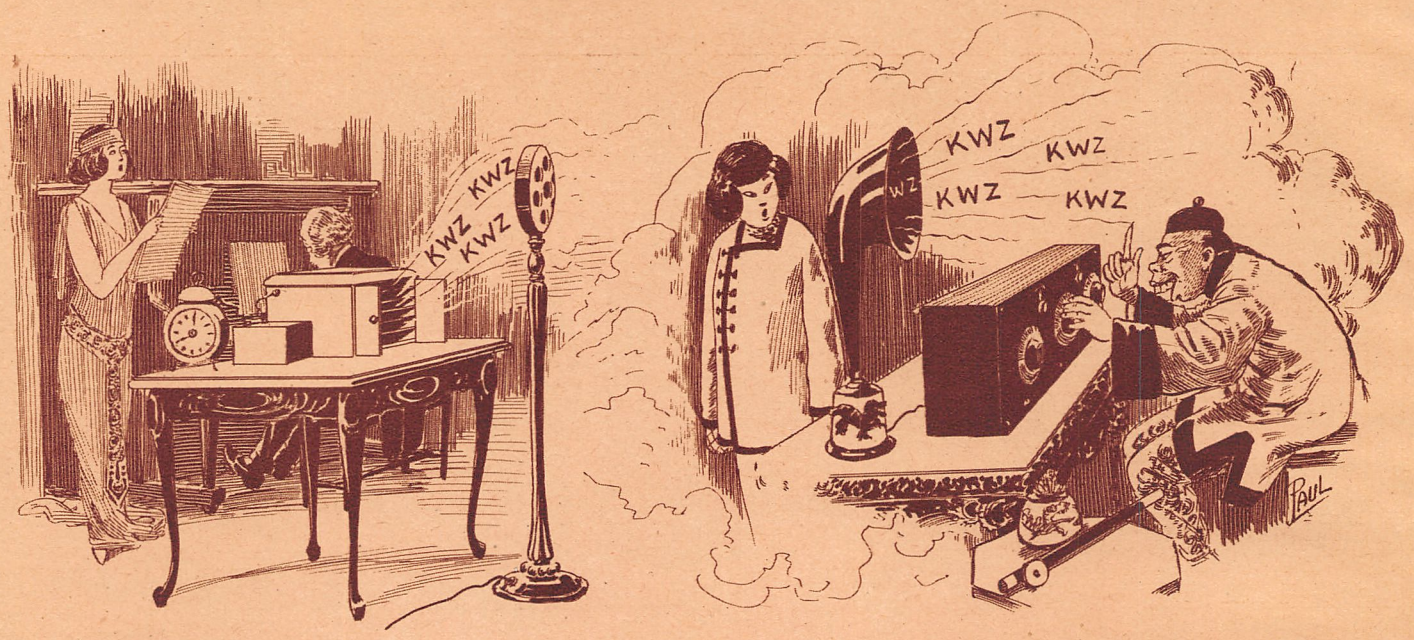


The former purveyor of political jargon had the advantage of displaying awsome gestures which, in synchronism with his silver tongued words, put his points across—but to a very small audience indeed.

Oscillations

By WILLARD WILSON



I suggest merely that special phonograph be used which are connected to alarum clock. Every two minutes Hon. clock shall pull highly sensitive trigger which starts phonograph which are placed near microphone as thusly shown.

To Editor of Radio News which are very edible mental feed for hams, fans, and other radio infected pepl. of globe.

Most Dear Sir:—

Since having been attacked by radio fever also,. I have became extremely aware of many pepl. which continually radiate huge talk about many broadcast announcers which do not give ultimate service, in pepl's idea.

Many fans, Hon. Sir. (which am I also) seem to un-appreciate gigantic benevolence of broadcast stations in even sending out dish-wash music—as such broadcasters receive no remunerating for same, but do it only for benefit of radio fans.

Such ingratitude in hearts of listening public are a source of unmodulated squeal-back in my mind, which at times are unable to be shielded from radiation to public. Oh, Hon. Sir. how pepl. crave huge amt. of everything for nothing!

Such complaints, however, I are glad to admit are most commonly out-putted by few fans which have became afflicted with horribly efficient disease of DX. As paper, also time are very limited, I will attempt to amplify only one stage of such complaining.

Namely: huge amt. of DX martyrs raise continual howl about announcers, operators, etc. which do not give call letters often enough.

"How," they yell squeakily, "can we tell which station is spouting, unless they give call letters after each sing-sing, speech, and other piece of program?

"You are unable," I admit glibly. "But why should you wish to hear such unamusing thing as this: 'this are station WOW,' or 'station KUF signing on,' Is such thing what you listen on radio for, or do you desire occasional music, talk, jazz, etc. from such?"

"Gah!" they blast uneasily. "But if we search for great period of time for distant station and hear faint squeak of music, we wish to hear where such are coming from. As poet once chuckled, 'DX lends enchantment to the ear.' And we will remain unchanted if station which we hear does not give call letters so we can tell where such are located."

Such fans, Hon. Sir, mantain with great amplification that each station should be forced to give call letters of self after each number. Others have became so far gone in last stages of DX that they wish call letters announced forth at beginning, middle, and also end of each number on program!

Typical ideal of DX hound would be announcers of each station merely giving call letters of such, repeated over and over for long periods every night. But that are impossible, and as a few pepl. remain which desire to hear occasional music, etc., as well as call letters, it are unprobable.

Radio announcers, as pepl. do not suspect, are sometimes human. Consequently, they do not greatly enjoy shouting forth all evening that this are station BVD, etc. Also they may occasionally become enthralled with sweet soprano or dance girl which are on program, and thusly forget to gargle forth call letters as numerous as desirable.

Yet, it are the very darn, Hon. Sir, to tune in with vernier care a Hon. station in great distance, and them have such fade before it are announced by call. I know, because I have done such a great amt. of times!

I was unintending to tell you that I were afflicted with DX also, but it has became escaped, so I will admit it. I are in advanced throes of disease, and therefore have evolved following useful plan. Namely: the phonograph.

"Curses!" you whoop gratingly. "Do you mean to drag out delapidated phonograph of broadcasting's infancy and give all programs of scratch-scratch records?"

"No," I thunder, with mild voice. "Heaven and the President of U. S. forbid!"

I suggest merely that special phonograph be used which are connected to alarum clock. Every two minutes Hon. clock shall pull highly sensitive trigger which starts phonograph which are placed near microphone. Each station shall have one phonograph record made with announcement of their call letters on such. Thus, even if manager of station forgets to whoop occasional spurt of call letters, phonograph alarum will do it for him with huge memory. Persons which happen to be singing, talking, yelling, etc. for entertainment of radio public, may pause for short section of time while such announcement are gargled forth from phonograph lungs. Station announcer may also take one drink while such announcement are made for him, thus saving piece of his wind.

If, however, they desire to continue song-sing music, such are extremely possible and will not interfere with phonograph announcement. Talking machine should be placed very close to microphone, thus giving good volume to two minute call letters which are whooped out automatically.

Such plan, Hon. Sir, are no doubt correct solvation of complaining DX dog. Hon. phonograph will save lungs of salaried station announcer, and also make more often and regular yell of station call letters. Such plan will cost each station merely price of having one record made, and will last for undefinite amt. of weeks.

This invention are gave by me to radio public without fee, and may be used with no ones permish.

I wave ancestral hand to you and indict myself as yours for more numerous call letters.

CHIN CHEW CHOW
Shanghai, Ariz.

A LETTER FROM MAH JONGG

To the Hon. Editer RADIO NEWS, *which says a mouthful genelly!*

Deer Ser:

In Aug. Radio News, page 179, Hon. Chin Choo Chow have exaggerated how greedy sing-sing writers and other newsances crave cash for Hon. copywritted songs broadcast from stations of huge sighs and demented, thusly additioning unpopularity of songs, which, he expire, radio fans should pay if any. This are unjust. Do we wish to here copywrited sqwalls sung by Hon. Saxyphone? No! I admonish!

I are not ailyenister, yet can prove all pop. crazy which insist Hon. payment should be made by tyrannied tuners-in, a wrong which

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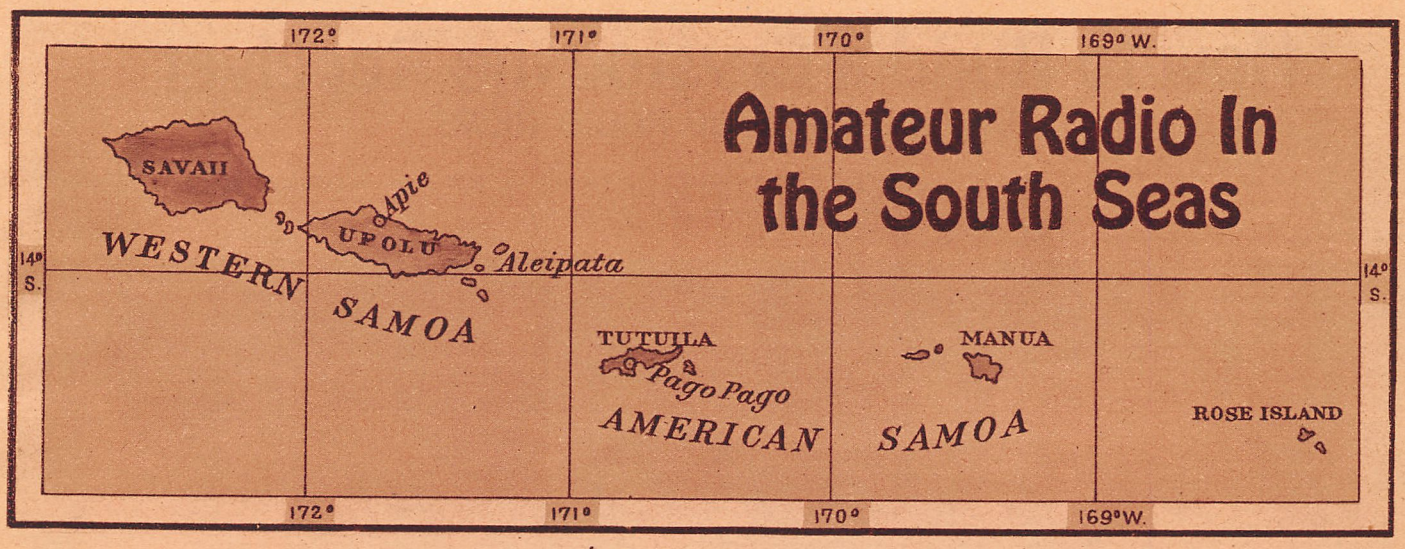


Amateur Radio In the South Seas

And One Instance When It Played An Important Role

By QUINCY F. ROBERTS

TAKE a map of the South Pacific search diligently in the little splashes of color and fine print sprinkled over the region south of the Equator, and you may find "Samoa Islands." In latitude 14 south and longitude 171 west they lie. The entire group is represented by a dot no larger than the *o* in Samoa. Unless your map is large, you may not find Apia, the capital and commercial center of Western Samoa, a metropolis of almost 2,000 people.

The little dot grows into two colonies of three large islands and several smaller ones.

Tutuila, the largest of the American group, is a mountainous island with the best harbor of the South Seas. A Governor appointed by the President of the United States resides at Pago Pago, making laws and administering justice to the 8,000 Samoans who live under the American flag. He is, also, the Commandant of the United States Naval Station. In the harbor of Pago Pago is a modern radio station, NPU, which communicates with San Diego and Pearl Harbor. If you are fortunate, the South Pacific Fleet may put into Pago Pago from one of its cruises. Your heart will not swell with pride as the fleet steams through the opening. It has not been commissioned to inspire wandering Americans with patriotism; it has been chosen for the more prosaic work of carrying supplies to the outlying stations and towing vessles in distress. The fleet is a sea-going tug.

A few miles west of Tutuila we come to the larger islands of Upolu and Savaii, administered by New Zealand under a mandate from the League of Nations.

NEW ZEALAND'S ISLANDS

At the eastermost end of Upolu towards Tutuila is Aleipata. The world's travel lanes pass the point of the island. Steamers from Australia, Japan, America and Europe pass by on the horizon without a ripple in the peaceful life of the village. Communication with Apia is by boat.

FATHER DUMAS

Father Dumas, a frail little Frenchman, is the parish priest at Aleipata. He is consulting engineer, watchmaker, and medical adviser to the community, as well as confessor to his flock. Not content with his many duties he has taken up the study of radio. He has a regenerative receiver and a two stage audio frequency amplifier. In Samoa he is known as the "Killer of Cocoanuts" due to the fact that he cut the tops of two trees for his aerial. His wireless experiments led to the filing of serious charges against him. The Samoans of his district attribute a recent hurricane to his antenna. They are satisfied that the mysterious box that buzzes like a hornet, sings and talks brought the storm from heaven down on their heads.

One evening I was idly listening in to the press from New Zealand. Apia radio acknowledged, the press then began calling ROB very slowly. I hurriedly reached for a pencil and took down the following message:

"Inform post office telephone line down three miles from Apia. DUM telegraphs

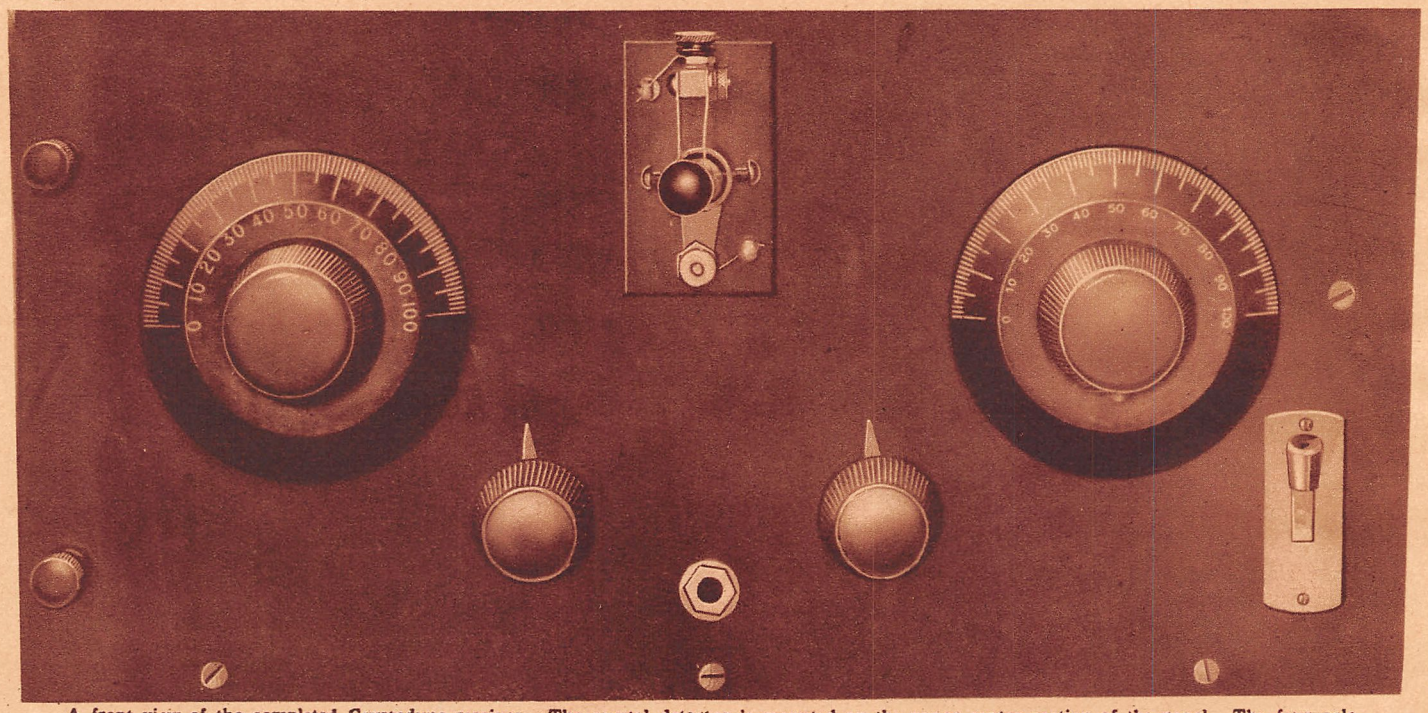
(*Continued on page 789*)

Two views of a portion of Pago Pago where tropical breezes blow through banana and cocoanut palms making a noise like ocean waves having broken on the beach; where nature shows all her splendor in riotous colors; where the sun's rays wither leaves, flesh and sometimes souls; storms release all their fury; in short where everything is beautiful one moment and ugly the next.

How to Build a Crystodyne Receiver

By THE STAFF OF RADIO NEWS

A simple form of experimental Crystodyne receiver the circuit of which is adaptable to a number of different tuning systems.



A front view of the completed Crystodyne receiver. The crystal detector is mounted on the upper center section of the panel. The four pole double throw cam switch to the right and below the condenser knob and dial is employed to switch from the audio frequency test circuit to the radio frequency or reception position.

THE receiver described in this article is an experimental model built in the RADIO NEWS Laboratories for the purpose of further investigation with the Crystodyne, or oscillating crystal, system of reception. In it are embodied the same elements as in the experimental type described in a former issue but arranged according to the usual method, on a panel and baseboard. By means of a key switch of the four pole double throw type an audio frequency circuit may be connected across the crystal detector for the purpose of finding a sensitive spot on the zincite crystal. The telephone receivers are connected across the audio frequency choke when the key is thrown on the test position and a whistle is heard in the telephones when a sensitive spot is found on the crystal, showing that it is oscillating.

To receive the incoming signals the key is then thrown on the radio frequency position and the variometer and condenser adjusted until the desired signal is tuned in.

The only delicate adjustment in such receivers is the finding and keeping of a sensitive spot on the crystal. It is necessary to avoid as much as possible, vibrations when tuning and it is advisable to mount the detector on sponge rubber or to devise some sort of elastic suspension to support it. It is also necessary to select a detector capable of staying adjusted after a sensitive spot is found on the zincite crystal, otherwise the least vibration knocks it out of adjustment.

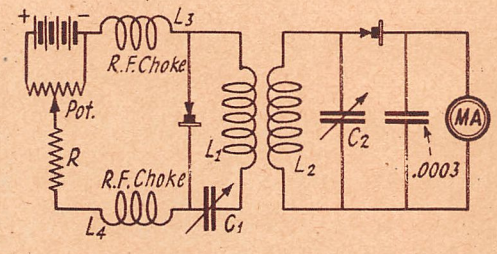


Fig. 3. In tests carried out in the Radio News Laboratories with the Crystodyne oscillator radiating a wave of 500 meters, it was possible to obtain one twentieth of a milliampere of rectified current when the pick-up coil L2 was three inches away from L1.

Before mounting the crystal in the detector cup several samples should be tested in a temporary mounting made with a clip in which the various pieces of crystal may be clamped for the purpose of testing them on their different faces. Once a sensitive crystal is found it may be permanently secured in the detector jack by means of screws or setting it into Woods metal.

It is possible, as explained in previous articles, to obtain regeneration by adjusting the resistance connected in series with the potentiometer. To receive continuous waves this resistance should be adjusted so as to let the crystal oscillate to produce a beat note. The potentiometer is in this set con-

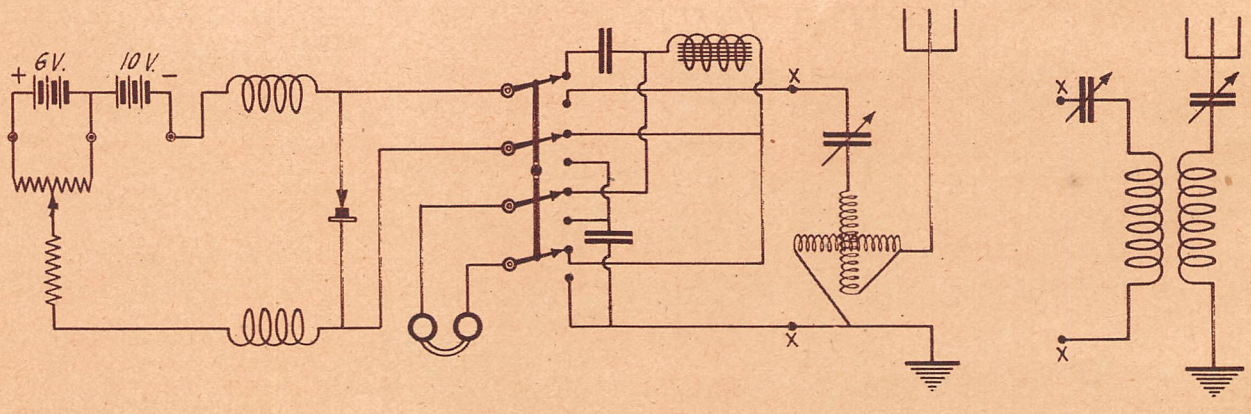
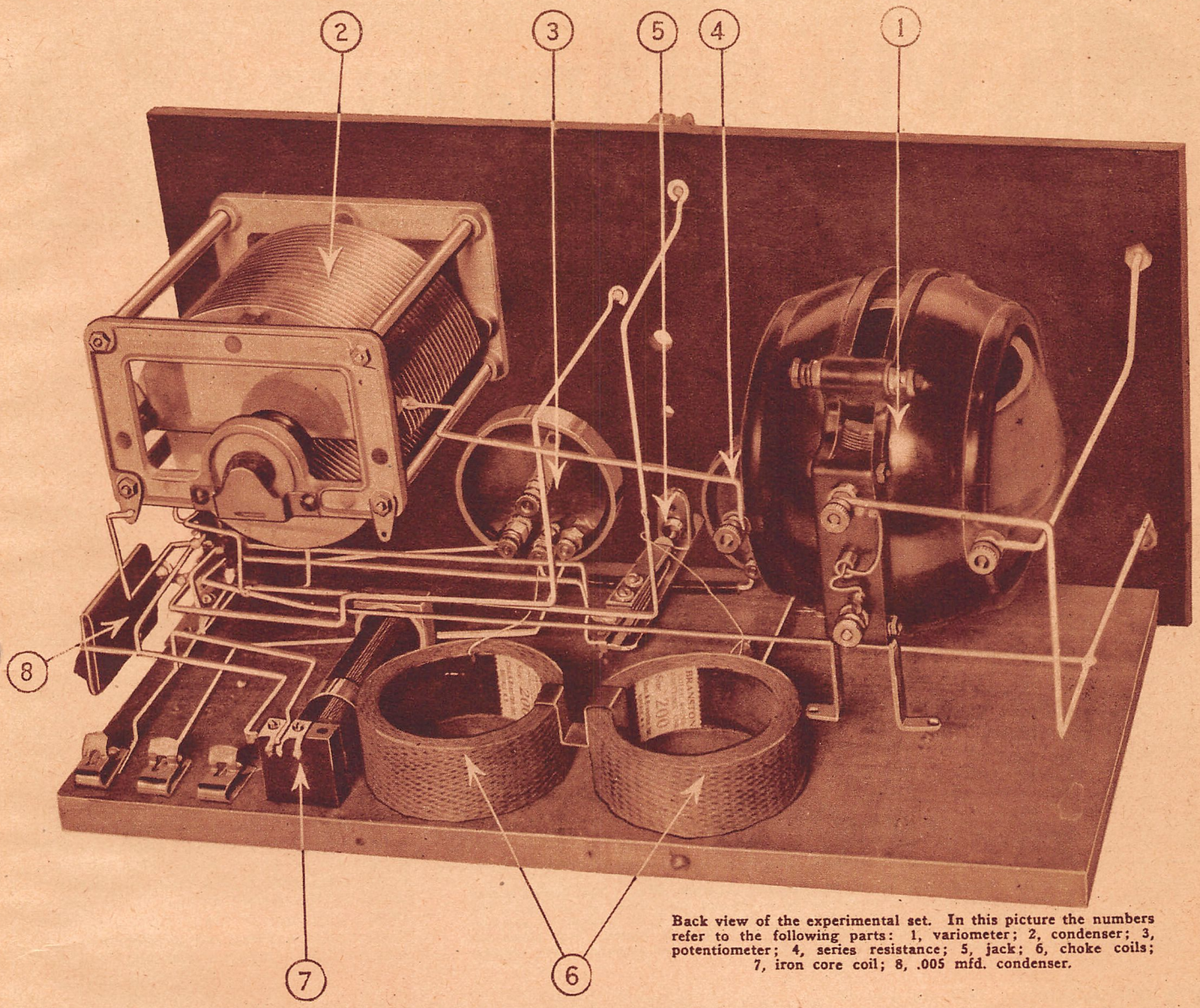


Fig. 1. The diagram of the experimental set shown on the photographs. Various tuning units may be used by connecting them at points XX in this diagram. Fig. 2, on the right, shows a loose coupled circuit which may be used with a long aerial.



Back view of the experimental set. In this picture the numbers refer to the following parts: 1, variometer; 2, condenser; 3, potentiometer; 4, series resistance; 5, jack; 6, choke coils; 7, iron core coil; 8, .005 mfd. condenser.

nected across part of the battery only as it has been found that this provides a sufficient voltage variation and reduces the consumption of current through the potentiometer winding.

It is possible to use the outfit described in this article as a separate oscillator which may be coupled to an ordinary crystal receiver or non-oscillating vacuum tube receiver to pick up C.W. signals. If the set is used for experimenting we would suggest that the various circuits shown in the last issues of this magazine be tried on this Crystodyne receiver, as some of them may prove more efficient than others, depending upon the conditions under which this set is used. Fig. 2 shows how a coupled circuit may be connected to the crystal circuit itself by changing the connection at point XX of the circuit Fig. 1.

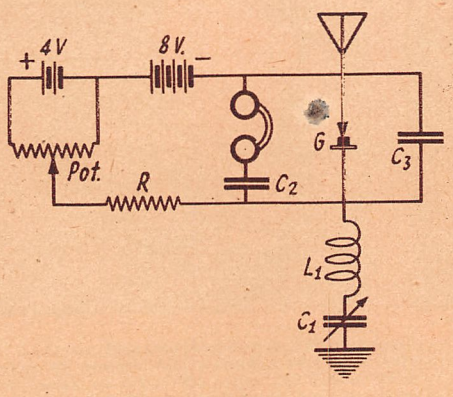
No constructional details are given for the assembling of this outfit since various apparatus may be used for the construction and especially since the outfit may be arranged for experimental purposes in so many different ways.

We have tried this oscillator for transmitting and found that signals may be heard within a short distance. When coupled to a receiving circuit, such as shown in Fig. 3, a rectified current of 1/20th of a milliampere was obtained with a coupling of about 3 inches between the variometer of the crystodine oscillator and the tuning coil of the receiving circuit. We are at the present time investigating the possibility of the zincite oscillator for the purpose of transmitting continuous waves over greater distance and we shall in time inform our readers of our findings.

The staff of Radio News is now investigating the effect of light, heat and of a magnetic field upon the crystal while in operation and we hope to be able to present to our readers the results of these experiments in future issues of this magazine. It is needless to say that we will welcome any communication from experimenters investigating oscillating crystals.

IMPORTANT NOTICE

All the Articles On the Crystodyne System Are Fully Copyrighted and Should Not Be Reprinted Without Giving Full Credit To RADIO NEWS



Another circuit which may be used in the set shown above.

THE COLLEGE OF THE AIR

"The only regular college course in the world which is given by radio—enroll in it."

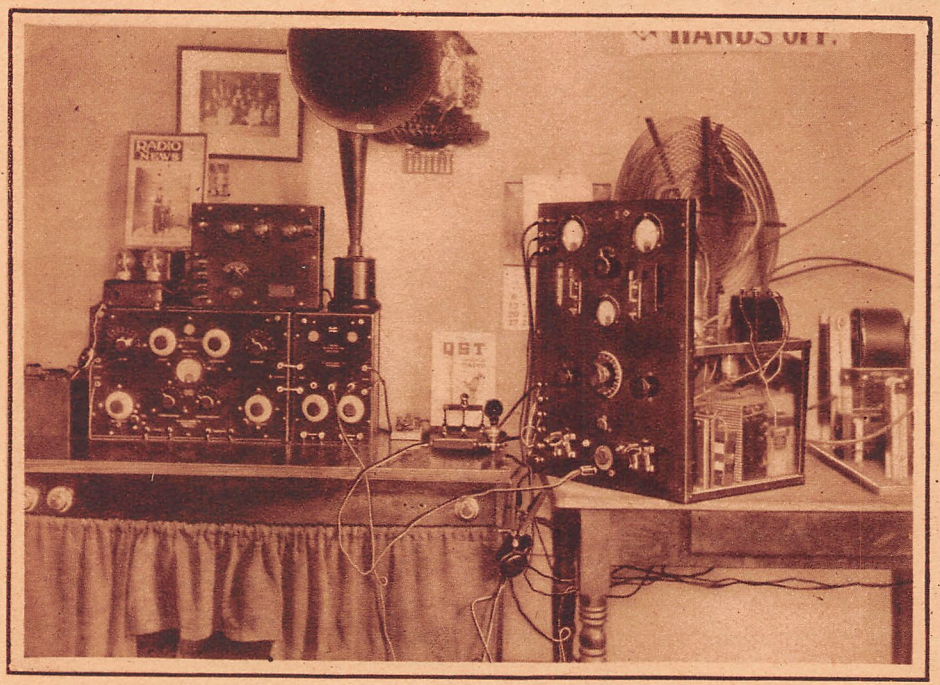
That was the cry that went out last year when the Kansas State Agricultural College started its "College of the Air" course, and it is still more lusty this fall as the announcement of the new and larger course is issued by the Extension Division of the college.

Interesting information on subjects ranging from law to the beef cattle industry, from the feeding of babies to the writing of business letters will be broadcast throughout the school year. Lectures are given Monday, Tuesday, Wednesday, Thursday and Friday evenings for four semesters of eight weeks each during the next school year.

The first semester starts October 15. Monday and Tuesday evenings are devoted to lectures on agriculture; on Wednesday evenings the engineer has his innings. How to build the house and landscape the

(*Continued on page* 846)

Radio In New Zealand



Station 9DCP, owned and operated by H. M. Degolier, London, Wis., The aerial, a four wire inverted L with caged lead-in, is supported by a 100-foot steel tower at one end. The counterpoise 14 wires in fan shape, is 20 feet above ground. The C.W. transmitter employs two 50-watters in the 1DH circuit, using rectified A.C. on the plates. The phone set employs a 500-watt oscillator, 50 watt modulator and a 5-watt special amplifier. The receiver is a Kennedy set.

BEFORE February, 1923, the way of the "ham" or the "bug" in New Zealand was a hard one. No amateur transmission was allowed at all and tube sets were not allowed unless the owner could read code. In spite of these hampering restrictions, however, a good many enthusiasts were doing good work in the way of reception. The regulations which were issued at the above time, however, put radio on a popular footing and there was at once a boom in the trade.

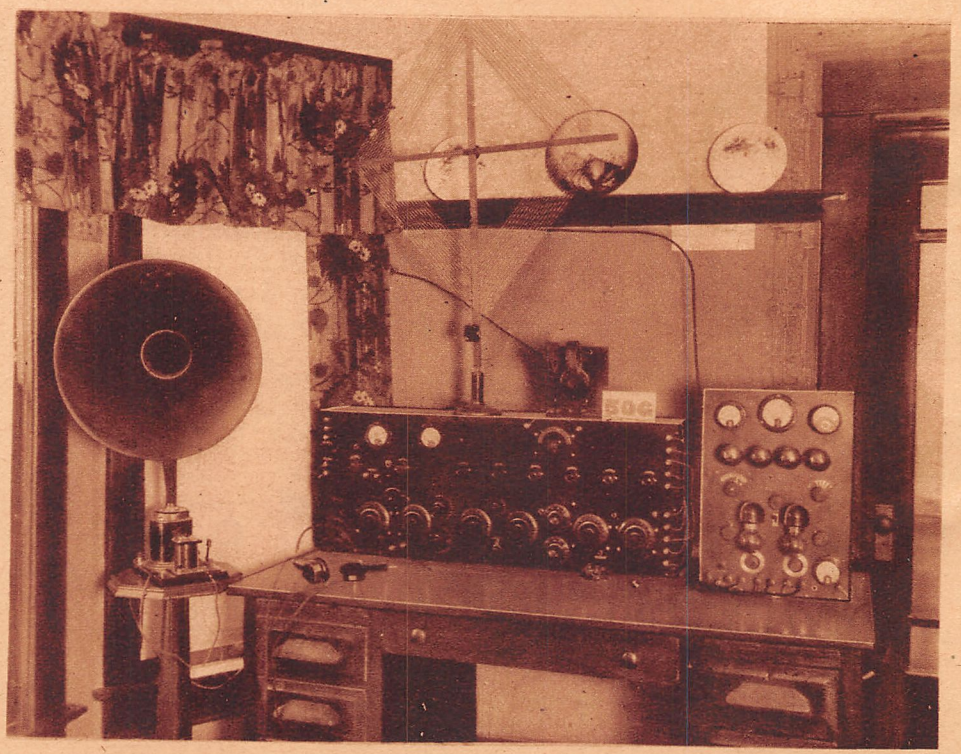
It may be interesting to you to mention the regulations and to see how they compare with the American position. To begin with, every receiver is licensed, the fee being five shillings ($1.25) per annum. Then—take good note of this—the single circuit is absolutely forbidden and to use one is to risk a fine of £10 ($50). Its loss is not mourned by anyone, for the ether is kept free from "birdies" and it seems that just as good, if not better, DX is accomplishd with the 3-circuit. Then again, there is no common wave for broadcast stations, different wave-lengths being allotted to towns before any stations are built there. At 14 of the larger towns stations may be built with an output of one-third kilowatt. These operate on a wave band of from 260 to 380 meters. This may seem rather narrow, but stations with near-by wave-lengths are situated at opposite ends of the country. The same applies to the wave-lengths from 190 to 250 meters which are allotted to 19 of the smaller towns. Stations built at these places may put 250 watts into the antenna.

There are at present eight stations in operation, which cover the country quite well, as DX of 1,000 miles on one tube is regular work here, many people getting the two stations in Sydney, Australia, on one tube.

Here, by the way, some of you ought to get a map out and convince yourselves that Australia and New Zealand are two separate countries. Australian enthusiasts have their sets sealed so that they can receive only one station, for which service they must pay.

However, to return to New Zealand, where we have a much better system, as you see, these stations are nearly all owned by radio dealers, or groups of dealers. The present stations range in power from 15 watts to 500 watts output. The only station now using the whole 500 watts is 4YA, Dunedin. This is a very efficient station and has some good DX reports from Australia. It is proposed in the near future to start a broadcasting company which will operate 500-watt stations in the four main cities, Auckland, Wellington, Dunedin and Christchurch. This will be a non-profit organization, subsidized by the Government out of the license fees, which will probably be increased slightly.

Reception of American broadcast stations is becoming quite common. KGO especially is easy to receive on good single tube sets. KPO, KHJ and WJAZ have also been received by the writer on one C-299. Many BCLs with two or three tubes get other Pacific coast stations, one gentleman having a list of 14 American stations. Not bad

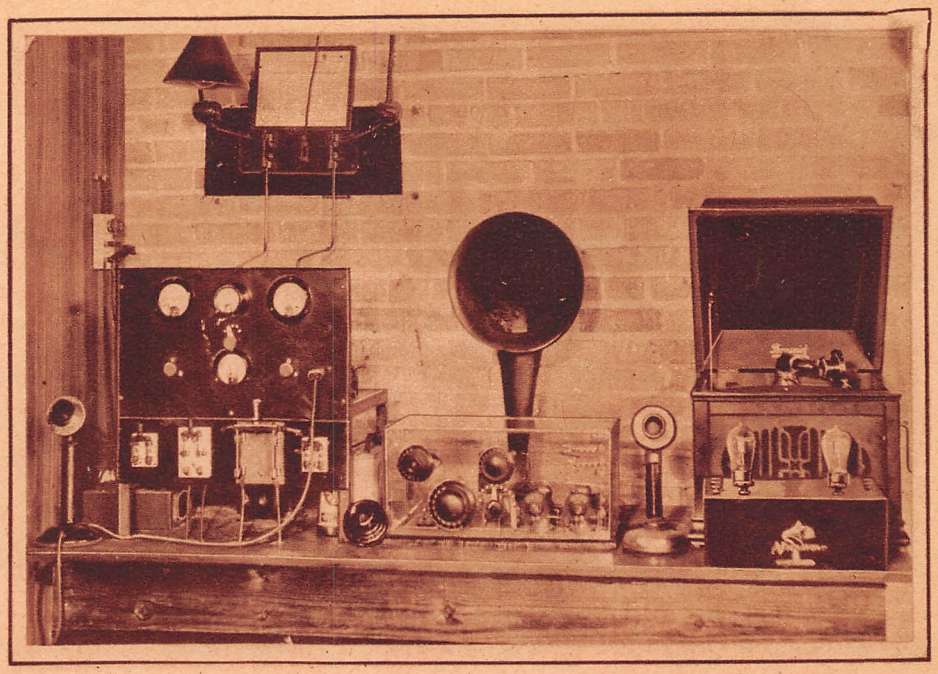


Station 5OG, owned and operated by O. S. Kelly, Oklahoma City, Okla. The transmitter uses four 5-watt bottles and crowds 80 watts into a six wire cage aerial, covering 2,100 miles with C.W. and 1,500 miles on voice, on 150-176 meters. The receivers is of universal type covering waves from the Hams' to 30,000 meters. This set has picked up Nice, France, Hawaii, WNP, Mexico City and others of like distance. It will be recognized as a Super-Heterodyne. It is of special design, however.

for those coupled tuners that have all the energy losses, eh, you single-circuit fiends. The distance from New Zealand to the Pacific Coast of America is just over 6,000 miles. The best DX so far, and incidentally, a world's record, is the reception of telephony, voice, from Eiffel Tower, France, by the government operators at Awarua, in the south of New Zealand. This was received several times at 6 o'clock in the morning.

However, to leave the BCLs and to get to the Laws. Up to now we have had two grades of amateurs, Grade I and Grade II. The first grade are allowed to use up to 50 watts (output), while Grade II, whose exam. for license is easier, have used up to 5 watts only. It is now proposed to have one type of license only, granting the amateurs a wave from 130 to 190 meters instead of 140 to 180 meters as at present. As has been continually demonstrated by lists of "Calls Heard," etc., since the first account of Mr. Ralph Wade's reception of American amateur signals, many other people are now logging numbers of them. Mr. Bell, 4AA, of New Zealand also has a report of reception of his signals in America. Unfortunately he did not log all his transmissions the night in question so unless some other "Z" ham heard him call CQ at the time mentioned, this cannot be verified.

No spark transmission whatever is allowed, as far as amateurs are concerned, in New Zealand, so our Hams do not have your spark QRM. The chief interference experienced is Nature's own model, static, although broadcast harmonics can, at times, be very annoying. There are at present only about 50 licensed amateurs, but the number is increasing all the time. Several amateurs transmit slow code for half an hour several nights a week, in order that BCLs may learn it if they wish. This idea is a very good one and is much appreciated by many who are thinking of getting transmitting licenses in the near future. American tubes are used by most of the transmitters, some of the lower powered of whom are now using 201A tubes in place of 5 watters, owing to filament economy. The little C-299 is a great favorite as a detector. It may be seen by what has been said in foregoing paragraphs that much good radio work has been accomplished in reception of American Hams, but transmission records are good too. Many even of the lower powered stations work with "Aussie" (Australia) regularly.



Station 5MF, owned and operated by Floyd L. Thompson, Bay City, Texas. The transmitter (phone only) employs four 5 watters, two as oscillators and two as modulators. The plates are supplied from a 500 volt motor-generator. The set puts 2.3 amperes into the antenna. Mr. Thompson states that he has eliminated the carrier wave and consequently it is impossible for his transmitter to take part in any heterodyning party. Note the glass encased receiver.

A great feature of radio work in New Zealand is that the Government, so far, has been very sympathetic with both Hams and BCLs. The Government station VLW, at Wellington, is shortly to use only I.C.W. during broadcasting hours. The Government has also been very good in the way of granting amateurs special permits, etc. Here are some of the world's records held in New Zealand, to show what good work is done.

List of World's Records held in New Zealand:

1. Reception of telephony from Eiffel Tower, France, by Government operators.
2. Reception of English amateur 5AU by Z1AC, Mr. Spackman.
3. Reception of CW from Australia 2CM, 1,200 miles, by Z4AA, Mr. Bell, when transmitter input was only .00375 watts (15 volts, .25 millamperes). The instrument with which the input was measured were afterwards checked and found correct within 10 per cent. The meter readings were taken by disinterested observers.
4. Z2AC, Mr. A'Meara, of Gisborne, worked CB8, Buenos Ayres, a distance of over 7,000 miles.
5. Loud speaker reception of KGO with small loop aerial using 8-tube Super-Heterodyne. Distance, 6,000 miles. Reception regularly done by Mr. I. Levy of Wellington.
6. More consistent reception of both amateur and broadcast stations over a distance of 6,000 and 7,000 miles is accomplished by New Zealand amateurs than by any others.

Station 2CPQ, owned and operatd by John C. Phipps, Brooklyn, N. Y. The transmitter employs a 50 watter in a Hartley tuned counterpoise—ground circuit. Plate current is secured from an Acme 200 watt transformer. The receiver is of the three circuit type and covers wave bands of 150 to 415 meters and 290 to 825 meters. 2CPQ has been heard in 23 States and Canada.

Amateur Stations Authorized to Use Short Wave-Lengths

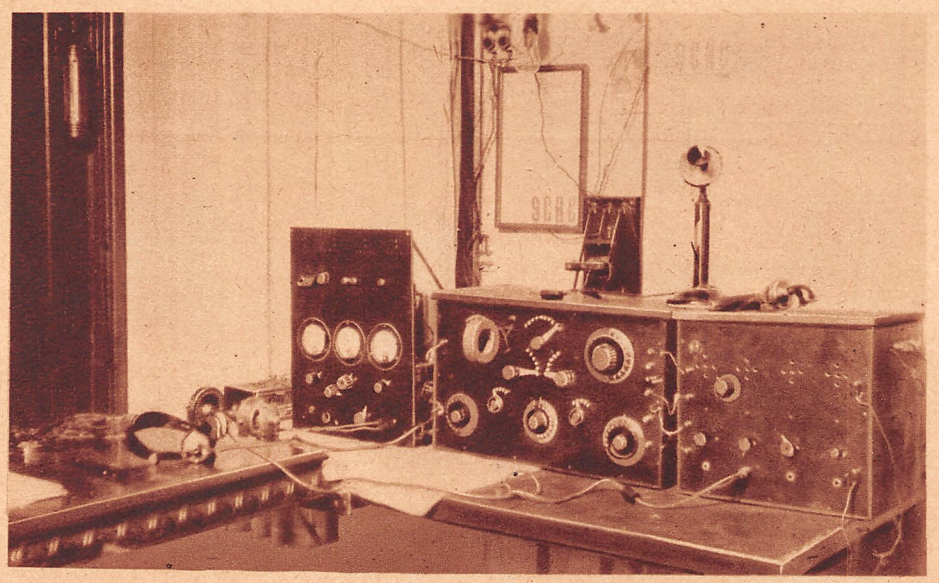
To all Supervisors of radio:

Effective this date you are authorized to issue general and restricted amateur radio station licenses to permit the use of any one or all of the following bands of short wave-lengths: 75 to 80 meters, 40 to 43 meters, 20 to 22 meters, 4 to 5 meters, in addition to the band 150 to 200 metres, provided application is made by the owner of the station, which station must be prepared to use the wave-length or wave-lengths requested.

The use of continuous wave telegraphy only will be permitted on wave-lengths other than 150 to 200 meters, and the antenna circuit must not be directly coupled to the transmitting circuit.

Silent hours will not be required of amateurs while using the wave-lengths within the above bands below 80 meters, except where the transmitting station is so situated as to produce objectionable interference with other services.

Hereafter special amateur stations will not use wave-lengths above 200 meters. They may be authoribed to use the band of wave-lengths from 105 to 110 meters in addition to the wave-lengths within the bands authorized for general and restricted amateur use where the special amateurs are engaged in conducting tests with Government or commercial stations.



Station 9CHC, owned and operated by H. E. Johnston, Spencer, Iowa. The transmitter employs four 5 watters in a modified Hartley circuit. Plate voltage is supplied by a 550 volt motor-generator. CW radiation on 150 meters is 2 amperes. Heising modulation is employed for fone and an R.C.A. choppr for I.C.W. The receiver is a three circuit and a Reinartz, both mounted in the same cabinet. Both coasts have been worked on C.W.

General, restricted, and special amateur stations will be permitted to use the entire band of wave-lenghts from 150 to 200 meters employing pure C.W. spark and modulated forms of transmission.

It should be made clear to the amateurs that the authority granted above is necessarily tentative because of the rapid development taking place in radio communication, and the bands of wave-lengths authorized may be changed whenever, in the opinion of the Secretary of Commerce, such change is necessary.

Approved—

J. Walter Drake, Assistant Secretary of Commerce.

D. B. Carson, Commissioner.

WASH DAY C.W.

By PAUL M. BARNES

Much has been said, and a great deal written bearing on the absorption of energy by imperfect dielectrics in the field of the antenna system. A recent experience of the writer may serve to point out the extent to which such absorption exists and may contain a hint to other amateurs.

Each Monday, following my usual daily custom of coming home to lunch, with a few minutes for DX work while awaiting its preparation, my signals were reported weaker than usual and the range of my station was considerably decreased over my daylight work on other days. This was so consistent as to offer a puzzle and a determination, on my part, to solve it.

Examination of the filament voltmeter and plate milliammeter readings showed that the current consumption was normal, which disproved a theory I had evolved that the power supply must be low on Mondays due to the excess load drawn by neighborhood washing machine motors.

Considerable thinking failed to bring to light any reason for such a phenomenon and as a last resort, I went out and gazed carefully at my antenna system. All was shipshape, and I thoughtfully started to return indoors when, with my thoughts far from my surroundings, I unexpectedly encountered a wet sheet, drying on the line. An idea! My wife, following the usual popular American fashion, washed on Mondays and the yard was hung full of wet clothes. I used no counterpoise, and the laundry hung directly under my antenna system. I endeavored to call back passages from authorities dealing with absorption and so meditating, requested my wife to aid science to the extent of removing all of the washing temporarily, which she did.

With the removal of the wet clothing and a comparison of signal strength with a brother amateur in a near-by town, by prearrangement, the difficulty was cleared up and the fact definitely established that the introduction of the large area of damp laundry between the antenna and ground resulted in a surprising loss of range for my station.

Not being able to persuade my wife to eliminate the washing of clothing altogether, I've followed the alternative course, and now refrain from attempts at daylight DX on Mondays!

NEW QRA'S

6SCC—Raymond Kridler, Box 204, Rivera, Calif.

1CV—Joseph Corish, 18 Prospect Hill Ave., Somerville, Mass. All crds QSL'd.

1DP—Thomas H. Bell, 36 Warren Ave., Pawtucket, R. I.

9ECA—(re-assigned) Leo W. Knaust, Granby, Mo. 10 watts CW. Pse QSL.

4VB—Ulmer G. Turner, Jr., 923 4th St., E. P., Columbia, S. C. 15 watts CW. and Fone. QSL's appreciated.

3RS-3CKC—E. Kampf, 817 14th St., N. W. Washington, D. C. All crds QSL'd.

4UC—(ex-2CUZ) Donald B. Whittemore, 925 Grandview Ave., Seabreeze, Fla. 100 watts D.C.C.W., 155 meters.

7MF—(re-assigned) Harold D. DeVoe, 1310 W. Main St., Medford, Ore. 50 watts CW. All crds answd. QRK?

7LS—(re-assigned) Earl Oliver, 701 W. Jackson St., Medford, Ore. 50 watts CW. All crds answd. QRK?

5ARI—Meade Johnston, Tuscaloosa, Ala. All crds answd.

9QQ—M. R. Johnson, 7816 Carpenter St., Chicago, Ill. 5 watts CW. QSL's appreciated. All crds answd.

2CLN—Myron B. Skraly, 1734 Weeks Ave., Bronx, New York. QSL's appreciated. Wave aprox. 85 meters.

6BGV—(re-assigned) Jack Lutts, 6551 National Blvd., Culver City, Calif. All crds answd.

300—Bert Carmosir, 1654 N. Marshall St., Philadelphia, Pa. Gld to get reports. All crds answd.

5APB—Roy Leach, Honey Grove, Texas. 10 watts CW. and Fone. Will QSL all crds.

6BX—A. Binneweg, Jr., 524 Fairbanks Ave., Oakland, Calif.

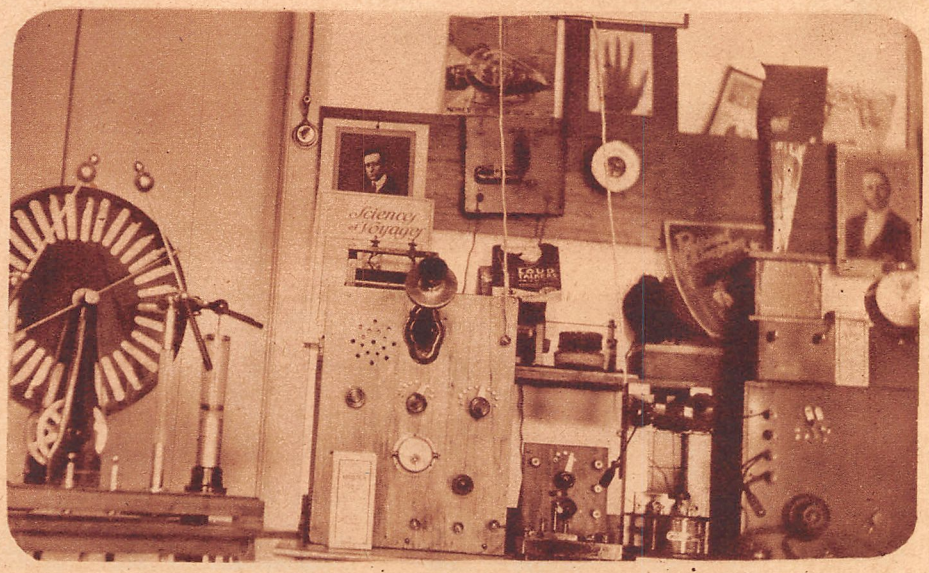
9BPW—Lyman Nylander, 2305 West 5th St., Duluth, Minn. All crds answd.

5APP—Ernest O. Ross, 6713 Ave. J, Houston, Tex. All crds answd.

5AQL—Brodie E. Cain, 715 N. Elm St., Denton, Texas.

CORRECTION—The call of the portable station owned and operated by Harvey B. Davenport, 1631 North 61st St., West Philadelphia, Pa., was published in the August issue of RADIO NEWS as 3APP. It should be 3AAP.

(*Continued on page* 812)



The amateur station owned and operated by Augusto J. Pereira, Pernambuco, Brazil. The transmitter employs one 5 watt tube. Plate voltage is secured from "B" batteries. Absorption modulation is employed for fone work. The receiver of the Honeycomb coil type has a wavelength range of 350 to 20,000 meters. A 6-wire fan shape counterpoise is employed in conjunction with the transmitter. All of the apparatus is home made.

Loop Antenna Transmission

By MARVIN S. OLSON

Enough cannot be published on loop transmission. In the future this or a similar system will no doubt be employed by the majority of amateurs for special work. Directional transmitters may some day be a necessity if traffic is to be handled.

THE use of a loop antenna for transmitting purposes has been ostracized by the general amateur fraternity on the ground that only very short distance communication is possible with it. While this is undoubtedly true at the present time, it must be remembered that the field of loop antenna transmission is indeed a fertile one, which will yield much in experimental and research work. It is the belief of the writer that future experiments will reveal the wonderful possibilities of the loop as a means of effective directional communication.

If loop antennae were used in connection with low power C.W. sets for local transmitting, a great deal of the amateur's interference would be obviated. This fact depends upon the directional transmitting and receiving properties of the loop. There is no necessity for the use of high power in communicating with a station within a radius of a few miles. A low power loop outfit could be made to accomplish this work, thus minimizing interference. Not only would interference be lessened, but new discoveries concerning the loop as a radiator would be made.

A METHOD

The most satisfactory method of producing high frequency alternating current in a loop antenna is to use the entire loop as the inductance of an oscillatory circuit. The loop may be used as only part of the inductance, but this will introduce unnecessary losses, and the results will not be as good as those obtained when the whole loop is used as the inductance.

Fig. 1 represents the loop transmitting set used in the experiments carried out at station 9AAG. It will be noticed that electrostatic coupling is used for oscillation generation. Condensers C1 and C2 each have a maximum capacity of .0005 mfd. A grid leak and grid condenser are not necessary as long as the plate voltage is kept below 200, but when the voltage is raised above this amount they will be found necessary. The tube is a regular five-watter.

If rectified A.C. is used, a 250 turn radio frequency choke, wound on a cardboard tube approximately three inches in diameter, should be inserted in the positive high tension lead.

The loop was built along the lines of general practice, being rectangular in shape and having seven turns of No. 14 D.C.C. wire wound on a frame with four-foot sides. This gave the loop a fundamental wave-length of about 176 meters. The actual transmitting wave-length may, of course, be varied by changing the capacity of condensers C1 and C2, which are of the variable type, or by varying the number of turns on the loop.

With a plate potential of 90 volts and a plate current of 4 milliamperes, a range of two and one-half miles was obtained. However, the directional characteristics were not as sharp as was expected.

It was then decided to change the size of the loop and vary the number of turns. In doing so, the turns of the loop were carefully spaced in order to obtain a high inductance with a low distributed capacity. Too high a distributed capacitance would render the use of short wave-lengths impossible.

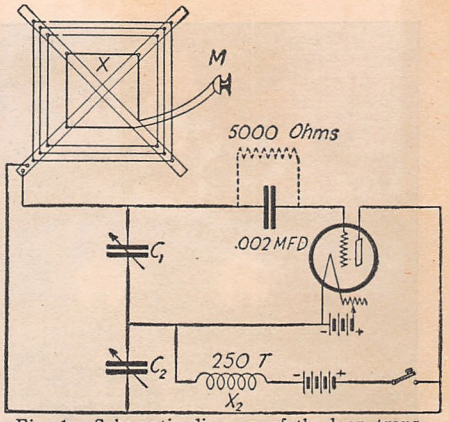


Fig. 1. Schematic diagram of the loop transmitter used at 9AAG. Absorption modulation is utilized when phone is desired.

The EXPERIMENTER

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER. Beginning with the November issue PRACTICAL ELECTRICS has been changed into an entirely new kind of magazine entitled

THE EXPERIMENTER

In this magazine, which has been greatly enlarged in point of contents, illustrations and circulation, you will find an entirely new treatment of *radio* entitled—

EXPERIMENTAL RADIO

Nothing but experiments, written by the foremost radio authorities, also a monthly editorial by the writer. A fine roto-gravure section to brighten up the magazine. But best of all for you radio readers, is the big radio section of over twelve pages of some fifty radio experimental articles—and mind you, NOTHING BUT EXPERIMENTS.

See page 732 for list of radio articles of the new EXPERIMENTER and be sure to reserve a copy from your newsdealer before the issue is sold out.

THE EXPERIMENTER will be on sale at all newsstands October 20, 1924.

HUGO GERNSBACK
Editor.

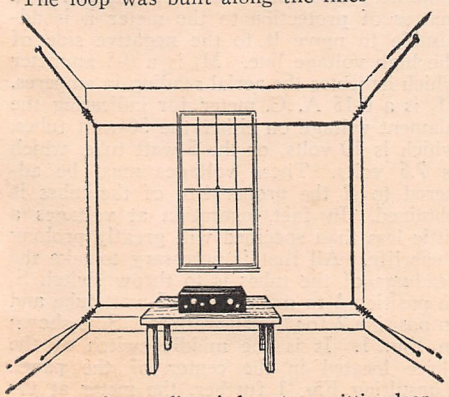


Fig. 2. An excellent indoor transmitting loop aerial supported from the four walls by strong cord and insulator.

Three turns of No. 14 D.C.C. wire spaced a quarter of an inch apart were wound on a six-foot-square loop. Using this loop with the same plate potential as before, the directional effects were much sharper, and the signal strength increased. This led the writer to conclude that the design of the loop had a great deal to do with the results obtained. Therefore, give this item careful attention, and do not be afraid to experiment.

As a word of caution to those who may desire to experiment with portable loop transmitters aboard some moving vehicle, be sure that the loop wires are strung as rigid and tight as possible. Failure to recognize this fact will result in a swinging wave which will spoil the reception.

For those who may want to try radiophone transmission, Heising modulation is recommended, although mediocre results can be obtained by the use of loop modulation. If the latter method is used, one turn of wire strung around the inside of the loop and connected to the microphone will give satisfactory results.

RADIOPHONE USED

Using the hook-up shown in Fig. 1 with loop modulation and a plate voltage of 500, a range of ten miles can be relied upon for voice transmission. The C.W. telegraph range will be approximately twenty-five miles. These ranges are quite conservative and can easily be duplicated or even exceeded by a little careful work in designing the apparatus.

Do not forget that a good receiving set has much to do with the success of your experiments. A common single circuit regenerative receiver with two steps of audio frequency amplification in connection with a 135-foot single wire aerial was used in the experiments just related. Although this gave fairly good results, the writer believes a loop receiving outfit having two or three stages of radio frequency and one or two more of audio frequency amplification would give superior results.

It must be remembered that the loop antenna's radiation is almost entirely electromagnetic. Hence the receiving set should be one which is highly sensitive to electromagnetic rather than electrostatic field variations. A loop receiving outfit is therefore desirable, since it responds almost entirely to the electromagnetic variations.

CONSTRUCTION OF LOOP

Perhaps it would be advisable to give a few suggestions concerning the construction of the receiving loop. So many articles on this subject have appeared in this and other radio periodicals, that only a few of the main factors will be considered here.

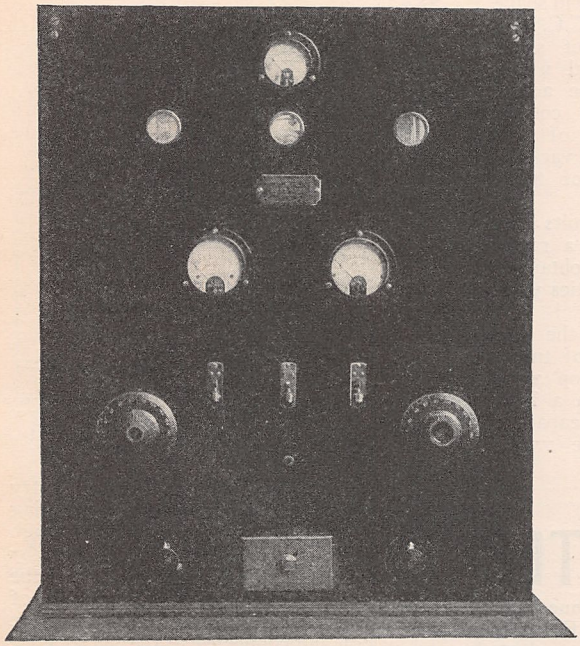
An important thing to be remembered in the construction of the loop, is that the greatest signal strength generally occurs at a wave-length of approximately two times the fundamental of the loop. Bearing this

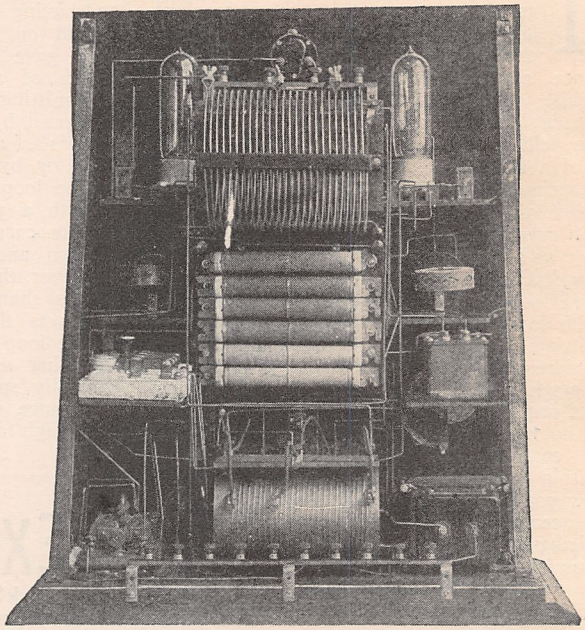
(*Continued on page* 774)

A 100 Watt Master Oscillator Transmitter

By JOHN E. FETZER, A.M., I.R.E.*

The description of an excellent C.W. and phone transmitter that bears all the ear marks of a commercial product. Electrical efficiency has not been overlooked or sacrificed for the sake of good appearance. Rather, the set was designed to include both.





Figs. 1 and 2 show the front and rear views of the 100 watt master oscillator transmitter built by the author. The two 50 watt tubes are seen mounted near the top of the panel. Note the neat arrangement of the apparatus. A large insulating strip mounted on the rear of the baseboard contains the necessary binding posts for outside connections. No terminals are placed on the panel proper.

IT is not unusual in these unsettled days to pick up a radio magazine and find the worn-out combination of words, "Knock-Out Set." In other words, the writer of such an article wishes to convey the impression that he has discovered the secret, has found the one set that supersedes all others. I sometimes think we have in the radio world many modern "alchemists" who are still trying to practice alchemy and transmute baser metals into gold. While I do not wish to belittle the original thinker, I do have the right to expect the truth when I read a description of an outfit.

Therefore, I must conclude that the set described in this paper is not a "Knock-Out." There never was a transmitter built which could not be improved. I do say, however, that a set of this type is well worth consideration on the part of any transmitting amateur who wishes to keep abreast of the times.

MASTER OSCILLATOR

In the first place, why is the master oscillator type of transmission so advantageous? There are probably three good answers. First, inasmuch as the master oscillator determines the wave frequency, the signals transmitted do not swing. Second, the wave can be controlled superbly, and last, the amplifier tubes are able to use all the power supplied to their plate circuit. This is because the efficiency of the circuit is high, owing to the fact that the grid losses are supplied by the master oscillator.

Figs. 1, 2, and 3 show the front, back, and side veiws of the complete set, designed and constructed by the writer. Fig. 4 shows the complete circuit diagram. The Hartley oscillator circuit is used. This consists of the 5-watt tube, V_3, condensers, C_6, C_7, and C_2, also inductance L_2. L_2 was constructed by using a 5-inch bakelite tube, wound with approximately 30 turns of seven strand No. 22 copper wire. It may be seen in Fig. 2 and Fig. 3 at the extreme bottom of the transmitter. It is arranged with clips so as to permit variation of both plate and grid inductance. This is for the purpose of securing effective regeneration by means of plate and grid high frequency excitation. C_2 is a 43-plate variable condenser connected directly across the inductance. This condenser forms the oscillation circuit which determines the wave-length of the master oscillator. This capacity is plainly visible in Fig. 3 and is the left dial control in Fig. 1. It has been the experience of the writer, in order to secure a steady wave, minimum inductance and large capacity must be used. The blocking condensers C_6 and C_7 must have a low power factor and be of mica construction. Their capacity should be large enough to have a low reactance at the working wave-lengths. A capacity of .002 mfd. is approximately correct for amateur waves. R_8 is two 5000 ohm grid leaks in series, making 10,000 ohms which was found high enough to hold the heat of the plate in the 5-watt tube to a dull red when the key is down. Of course, when the key is up the oscillator should be practically cold. R_8 is shown in the bank of leaks in Fig. 2. L_3 is a single layer radio frequency choke which is shown in Fig. 3, center shelf, beside L_6. L_4 is identical to L_3, located on the same shelf. L_7 is identical to L_6, shown at the left, center shelf, Fig. 2. It is recommended, however, that L_6 and L_7 be replaced with single-layer coils, as concentrated inductances invariably have high enough distributed capacity to by-pass sufficient radio frequency to make the choke ineffective. A good single layer coil can be constructed by winding 250 turns of No. 28 cotton covered copper wire on a 3-inch tube.

The high voltage for the plates is furnished by a 1,000-volt direct current generator, G. This generator is driven by the motor A_1 from the 110 A. C. line. G. F. is the generator field and R_2 the generator field rheostat, which permits regulation of the generator voltage. As to the filter arrangement, C_{11} is a 2 mfd. condenser and L_5 is a 6 henry choke. While these values are adequate for this particular circut, they may not be effective under other arrangements than the one employed. The motor-generator is not shown, it being installed at a distance. The choke L_5 is shown in Fig. 2 at the bottom right and in Fig. 3 directly at the bottom. The choke shown is not a 6 henry choke but a smaller commercial type.

THE OSCILLATOR TUBES

The oscillator tube V_3 receives its plate current from the same source as the 50-watters. However, the voltage must be reduced from 1,000 to 500. A large commercial grid leak will serve well. One of these leaks will dissipate about 60 watts of energy continuously or 100 watts intermittently. The plate resistance of a 5-watt tube is approximately 4,000 ohms. If the plate voltage is to be equally divided between the tube and this resistance, that is, 500 volts on the plate and 500 across the resistance, the resistance should have a value of 4,000 ohms. However, the difference between 4,000 and 5,000 ohms seems to be negligible and works out very well in practice. This leak is indicated at R_5 and is shown in Fig. 2, in the bank of leaks.

M_3 is a 0-500 milliammeter which shows the total amount of current drawn by the amplifiers and the oscillator tube. As a matter of protection to the meter it is advisable to move it to the negative side of the high voltage line. M_1 is a 0-5 ammeter which indicates the aerial reading in amperes. M_2 is a 0-15 A. C. meter for indicating the filament voltage on either the 50-watt tubes, which is 10 volts, or the 5-watt tube, which is 7.5 volts. These voltages must be adhered to if the proper life of the tubes is obtained. In fact, operation at voltages a little less than specified will greatly prolong their life. All that is necessary to take the readings of the tubes is to throw switch S_5 in position 1 to measure the 5-watt tube and in position 2 for the 50-watters. S_5 is shown in Fig. 1. It is the middle switch of the three located in the center of the panel. Consulting Fig. 1 further, the meter at the top is M_3, the one at the right center is M_2 and at the left center, is M_1.

*Chief Engineer Station KFGZ

FILAMENT HEATED BY A. C.

A. C. is used on the filaments for economy and prolonged life of tubes. It is well known that the life of the tubes is greatly lengthened by using A. C. on the filaments, because one half of the filament is not overloaded as in the case of direct current. The transformer T with P and S, the primary and secondary, can be seen in Fig. 2 just behind the master oscillator inductance. C_8 and C_9, two by-pass condensers, are shown across the secondary of the transformer, but really are not needed if the center tap on the transformer secondary is located at the exact center of the winding because there will be no effective inductance between it and the ends of the secondary coil. Notice that the center tap is grounded.

Two rheostats R_3 and R_4 are used to reduce the voltage from the secondary of transformer T, to the desired 7.5 volts for the 5 watt tube, which is indicated on M_2. R_6 regulates the primary of the transformer. R_3, R_4 and R_6 are all standard commercial rheostats. R_3 and R_4 are shown at the bottom of the panel, Fig. 1. Switch S_4, when closed, puts both the transformer and motor-generator into operation. Owing to the fact that the generator is a little slow in starting, the filaments of the tubes are lighted before the plate current is applied. This precaution should always be taken. Never apply the plate voltage before the tubes are lighted. If it is done, the result, in time, will be disastrous to the tubes. S_4 is seen in Fig. 1, the switch located at the centre bottom. Switch S_3 is the 110 A. C. line switch and is shown in Fig. 2 at the middle left.

POWER AMPLIFIERS

Two 50-watt tubes, V_1 and V_2 are used in parrallel for the power amplifier. They may be seen in Fig. 2. The oscillator tube is in the center on the same shelf of the same

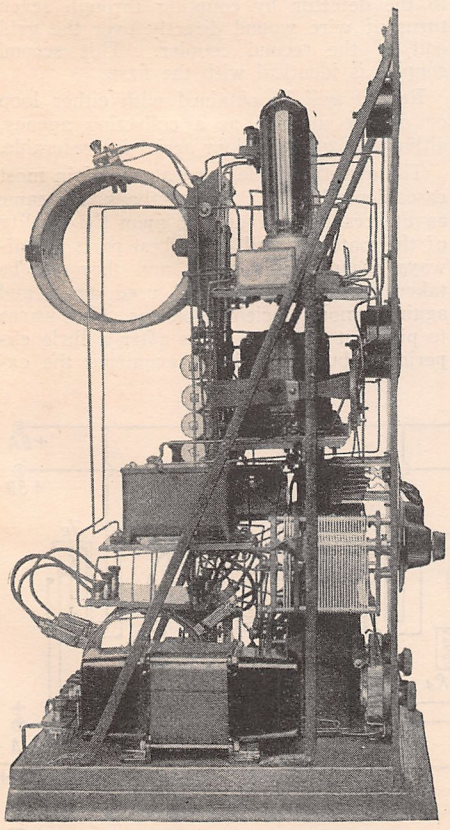
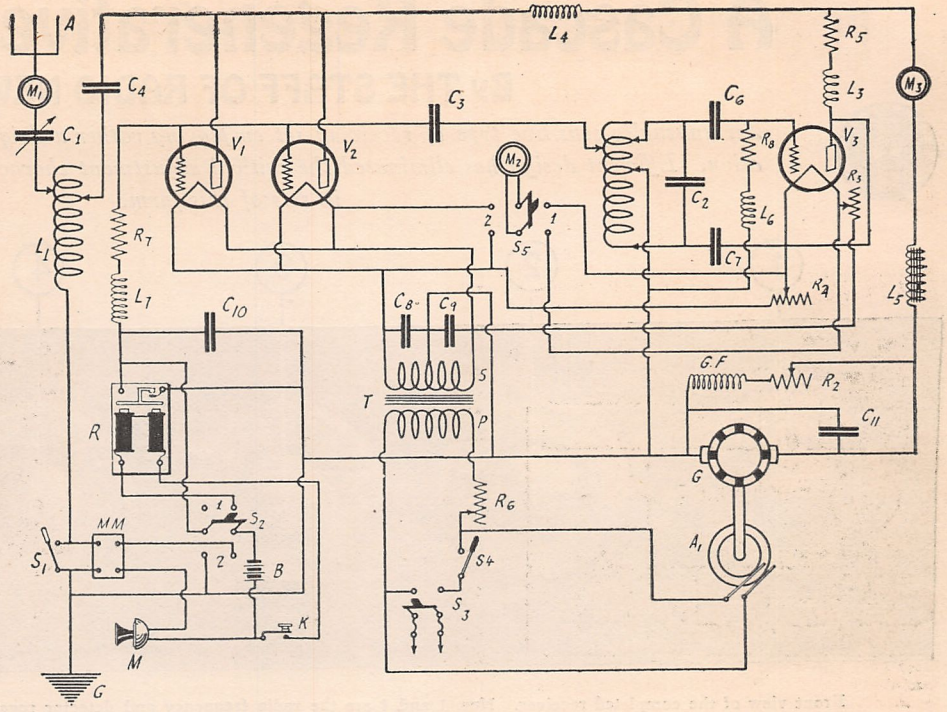


Fig. 3. Side view of the 100 watt transmitter. All instruments except the motor generator are mounted in this unit.



Schematic wiring diagram of the complete 100 watt transmitter. The Hartley oscillating circuit is employed in this circuit. A relay-operated key is used for code work. Switches are provided for changing from C.W. to Phone.

view. All three tubes may be seen through the peep-holes in Fig. 1. C_3 and C_4 are each .002 mfd. of the mica type and are located by the side of the two 50-watters in Fig 2. A full view of C_3 may be seen in Fig. 3. L_7 is 15,000 ohms, three leaks in series. These are shown in Fig. 2.

The keying of the transmitter is done through a relay R, which may be seen in Fig. 2, shown at the bottom, on the left. As shown in circuit diagram the relay is inserted in series with the grid-leak. By this means the power amplifier is completely blocked when the relay is open. The contacts of the relay are shunted with a .002 mfd. condenser C_{10}. This affords protection for the tubes as it decreases the possibility of leakage. The key K, operates the relay through battery, B, when switch S_2 is in position 1. When this switch, shown in Fig. 1 at the right center, is thrown in position 2 the contacts on the relay are shunted out and the microphone is cut into the magnetic modulator, circuit M. M. The same battery, B, is used to furnish the microphone current. Switch S_1 must be open for telephony and closed for telegraphy. S_1 is shown in Fig. 1, left center. The magnetic modulator proves very satisfactory for phone work, however its being embodied in this installation is only incidental and is used only for local communication. The magnetic modulator is shown in Fig. 2, immediately above the choke coil.

L_1 is shown in Fig. 2 and Fig. 3 at the top of the set. It has 25 turns. C_1 is identical to C_2, previously mentioned. This is shown in Fig. 2, the right dial control. A shows the antenna and G the ground. The dimensions of the bakelite panel are 27 by 36 inches. The base is solid oak and supports the panel through screws at the bottom and the cast iron brackets as shown in Fig. 2 and Fig. 3. Fig 2 shows at the bottom, the binding posts, located on a bakelite strip near the edge, in order to make convenient as well as short connections. At the top of L_1 is shown another row of posts, for aerial, ground, etc.

TUNING

All connections must be as short as possible, have good insulation, and be free from bad wiring and high resistance.

The tuning of this set is much easier than the self-excited systems. In order to find the proper place for the plate clip on L_1, bring the master oscillator and power amplifier into normal operation with full plate voltage. Then hunt for the position on the oscillation transformer where the heat from the plates of the vacuum tubes is low. Also where a low plate current obtains. Try this adjustment until this condition is obtained over a wide range of wave-lengths. However, the plate *current* should not exceed a tenth of normal value, when making this adjustment.

The antenna tuning is very critical. The whole antenna system must be brought to resonance with the wave determined in the master oscillator circuit. This will be done by proper adjustment of C_1 and antenna clip on L_1. Resonance will be indicated when maximun radiation is obtained as shown by M_1 and by a wavemeter reading at L_1 as compared with a similar reading at L_2.

This matter of radiation is perhaps the most deceiving problem in amateur radio. With this type set it is not uncommon to find high radiation, but low efficiency. This may be caused by proper ratio of turns on the oscillation transformer but too few turns used in both plate and aerial inductance circuits. Also too low a grid-leak resistance would cause such a result. If the output is low and the efficiency high the cause is probably a high resistance antenna or wrong adjustment of both plate and antenna clips on L_1. However, a low antenna current is always had when operation is essayed below the fundamental of the antenna. The current in this case may be just a small fraction of that obtained above the fundamental, but with this condition, greater signal strength and greater range are the almost invariable result.

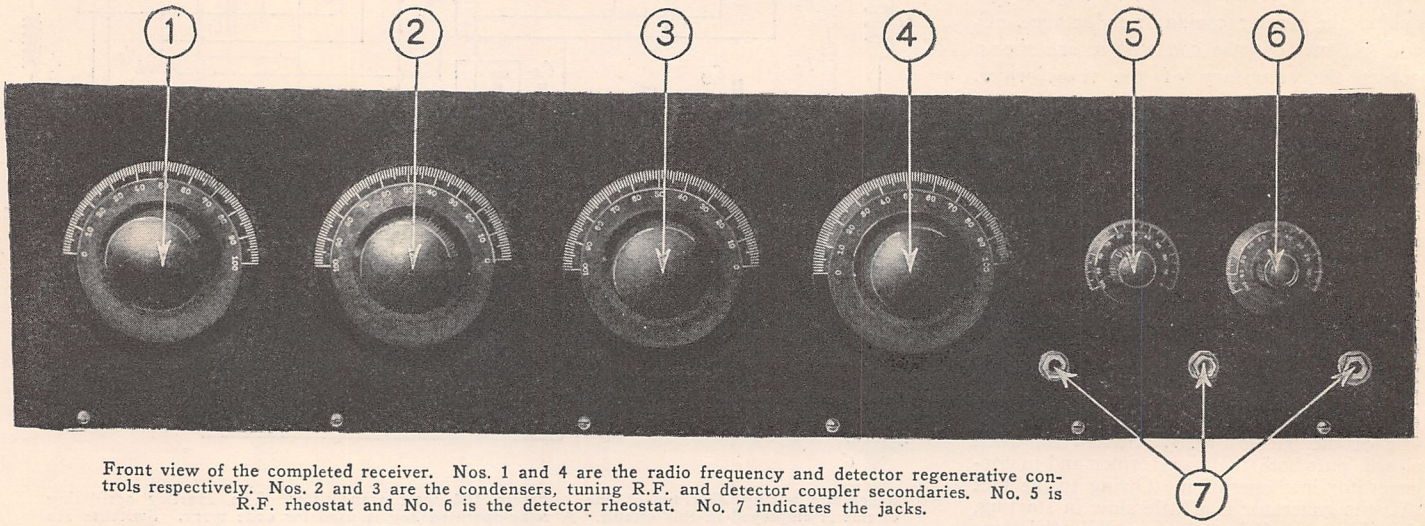
The writer has had experience with master oscillator sets both in amateur and broadcast work and can state without question, that this type of transmission is certainly wonderful as compared with some of the self-excited systems and that real pleasure is derived from its beauty in perfection.

However in building a set of this kind one must be a firm believer in the motto that *"workmanship is craft and accuracy is law."*

A Cascade Regenerative Receiver

By THE STAFF OF RADIO NEWS

An unusually sensitive type of receiving set employing rather a unique system, cascade regeneration. Efficient design has eliminated the critical adjustment characteristics usually manifested in sets of this form.



Front view of the completed receiver. Nos. 1 and 4 are the radio frequency and detector regenerative controls respectively. Nos. 2 and 3 are the condensers, tuning R.F. and detector coupler secondaries. No. 5 is R.F. rheostat and No. 6 is the detector rheostat. No. 7 indicates the jacks.

A NEW idea in radio frequency amplification is applied to this Cascade Regenerative Receiver. In practical form it has been tried and has given excellent results. The two tubes used as radio frequency amplifiers and the regenerative detector give approximately the same results as four stages of radio frequency amplification. The set is no more difficult to tune or control than an ordinary receiver and at the same time is exceptionally stable.

The idea is comparatively simple. The plate current of the first tube is fed back through the tickler, giving regeneration in the antenna circuit. The output of this first tube is passed to a second tube which is used as a resistance coupled radio frequency amplifier of the ordinary type and acts also as a blocking tube, keeping the first and second regenerative circuits entirely separated. The output of this second radio frequency amplifier is passed, in the regular manner, to the detector, which also is regenerative.

In the present instance, two stages of audio frequency are added to the set in the regular manner.

Following is the list of apparatus necessary to construct the cascade regenerative receiver:

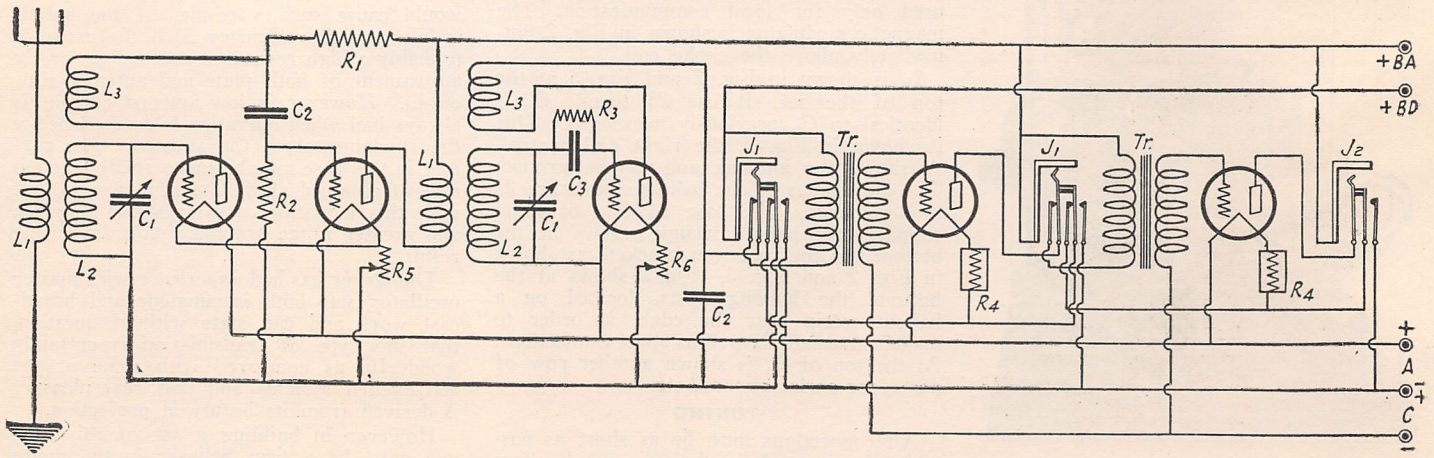
1—7 x 28 inch panel.
1—7 x 27¼ inch wood baseboard.
2—.0005 mfd. variable condensers.
2—special variocouplers.
1—variable resistance 10,000—100,000 ohms.
2—2 megohm grid leaks.
1—.00025 mfd. fixed condenser with leak clips.
2—.0005 mfd. fixed condensers.
1—6 ohm rheostat.
1—20 ohm rheostat.
2—automatic filament adjustors for U.V.-201A type tubes.
2—medium ratio audio frequency transformers.
2—double circuit filament control jacks.
1—single circuit filament control jack.
4—four inch dials.
8—binding posts.
5—standard sockets.
Various wood screws for fastening apparatus to baseboard.
1—strip of insulating material 5 x 2 inches for binding posts.
1—strip of insulating material 2 x 2 inches for binding posts.

The secret of the set's success lies in the blocking tube used between the first and second regenerative circuits. Oscillations are controlled entirely by the two ticklers, there being no potentiometer which adds greatly to simplicity of control. Coupling between the aerial and first radio frequency circuit is made through an aperiodic primary system, the aerial coil consisting of seven turns wound directly over the grid coil of the coupler and not tuned.

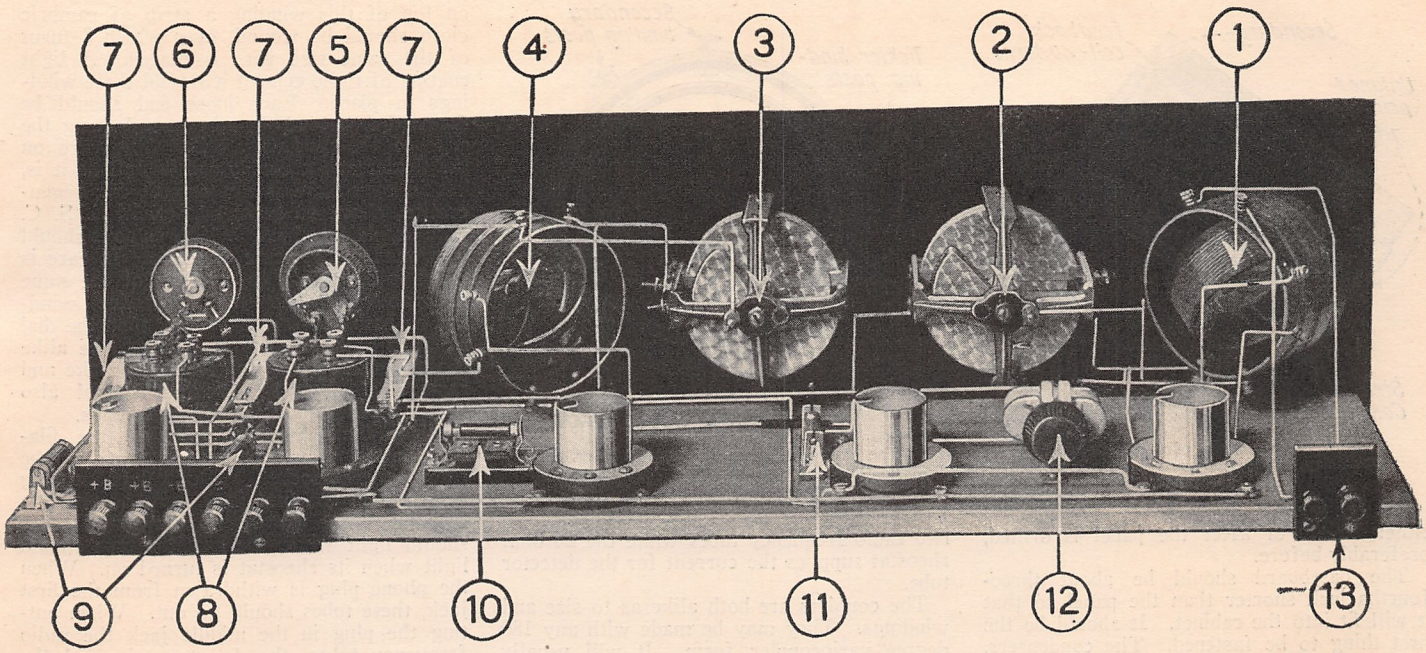
The second radio frequency amplifier tube is connected to the first through resistance coupling. The output of this tube is passed to the detector by coupling through seven turns of wire wound directly over the grid coil of the second coupler. This second coupler is identical with the first.

Results will be obtained with either loop or outside antenna as a collecting agency, although a good outdoor aerial is preferable.

The quality of the apparatus will in most cases depend upon the pocketbook, the same as the results will depend upon the quality of the material used. The best parts are always cheaper in the end and they can be taken out of one set and used again and again in more efficient hook-ups. One learns to pick out the good parts after a little experience, but while he is acquiring the ex-



Schematic diagram of the circuit employed. The numbers designate the following parts: L1, L2, L3 are the primary, secondary and tickler of the couplers; R1, variable resistance; R2, R3, two-megohm grid leaks; R4, amperites; R5, six-ohm rheostat; R6, 20-ohm rheostat; C1, .0005 mfd. variable condensers; C2, .0005 mfd. fixed condensers; J1, double circuit filament control jacks; J2, single circuit filament control jack.



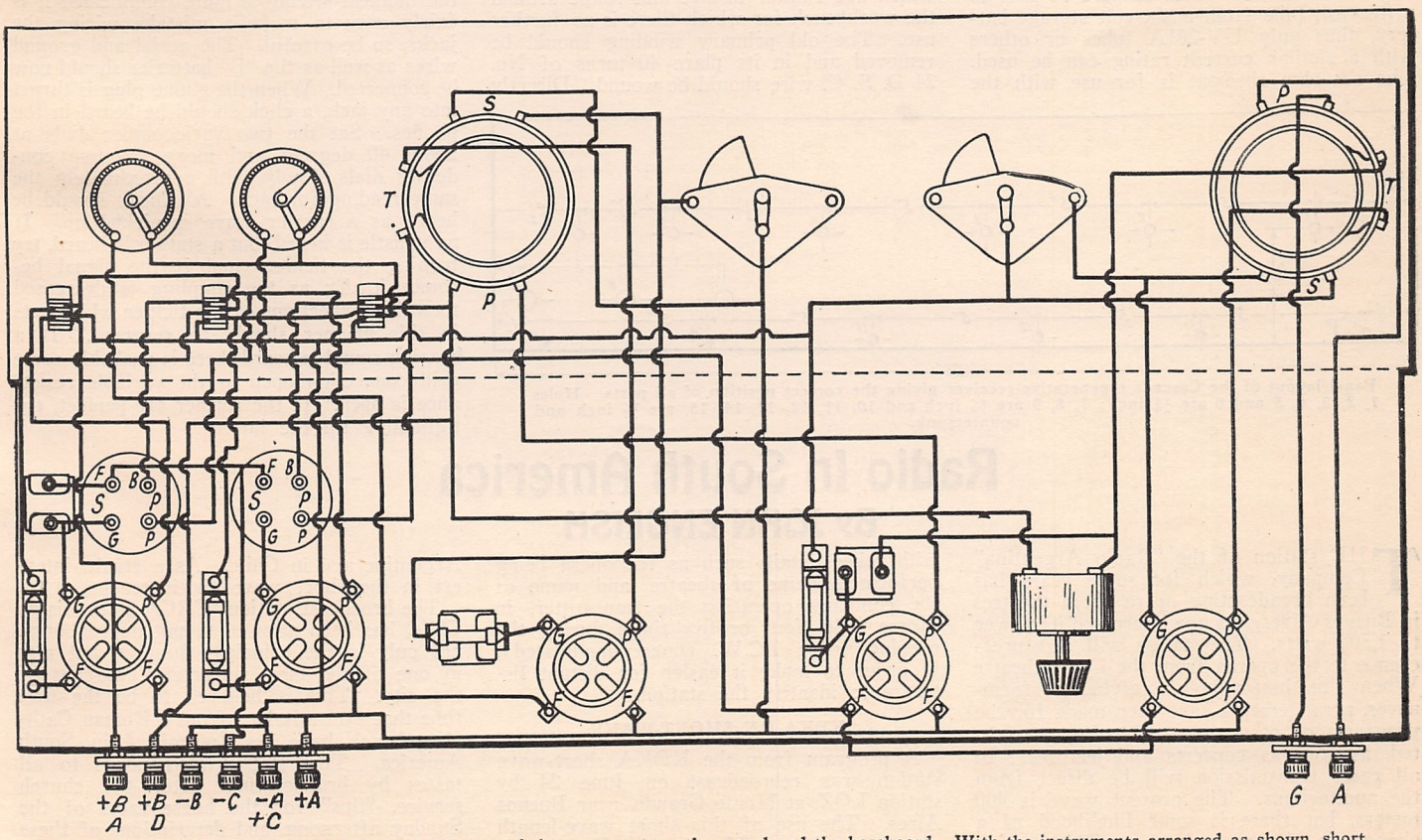
Rear view of the receiver. The numbers designate the following parts: 1 and 4, variocouplers; 2 and 3, .0005 mfd. variable condensers; 5, six-ohm rheostat; 6, detector rheostat; 7, filament control jacks; 8, A.F. transformers; 9, amperites; 10, grid condenser and leak; 11, two-megohm grid leak; 12, variable resistance; 13, antenna and ground connections.

perience he had better buy from the dealer who guarantees merchandise.

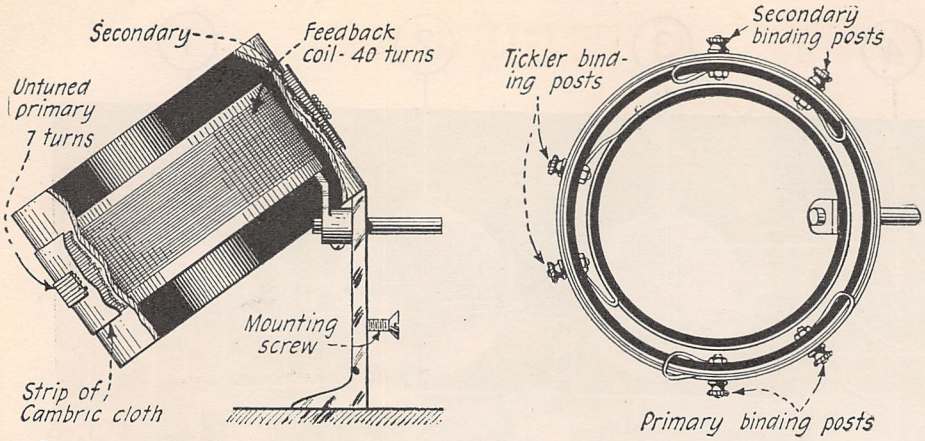
After all the parts have been secured, the first thing to be done is to mark and drill the panel. The parts used in the model set are all of standard size and manufacture which allows the reader to place his apparatus in the same position, if desired. There are two ways of marking the panel. One is to secure a piece of heavy paper and cut to the exact size of the panel, and then draw a line across the paper exactly in the center. The center holes for all instruments, with the exception of the jacks, will be made on this line. The measurements for the mounting screw holes can be made from the instruments themselves or the templates may be used. Another line is drawn 1½ inches from the right lower corner of the panel, on which the three jack holes will be drilled. After the centers of all the holes are marked the paper is pasted on the panel and an impression is made on the surface of the panel with a center punch and hammer. After drilling all of the holes with the proper size drill, a countersink should be used on all holes through which a machine screw is to pass so that the dials can be set close to the panel. The paper template can be removed before drilling is started and used over again if desired. The second method of operating the panel is to measure off the instruments on the panel and mark each hole with a center punch as it is measured.

FINISHED PANEL

In some cases it may be desired to have a grained finish on the panel. The requisites are some pumice powder, thin lubricating oil or linseed oil and some rags. The panel should be made fast to the workbench by fastening a thin brace to the table on all four sides of the panel. A little oil should be spread on the panel and a small amount of the powder sprinkled on. Care should be taken that the surface is rubbed either lengthwise or crosswise, but not both, as this will do anything but improve the looks of the finished product. When the desired finish is procured, a little oil should be spread on the surface and rubbed with a clean cloth until it is perfectly dry. This can be done



Layout of the receiver showing the arrangement of the apparatus on the panel and the baseboard. With the instruments arranged as shown, short leads are obtained and the wiring is greatly simplified. Only by careful wiring, well soldered joints and short leads can maximum results be obtained.



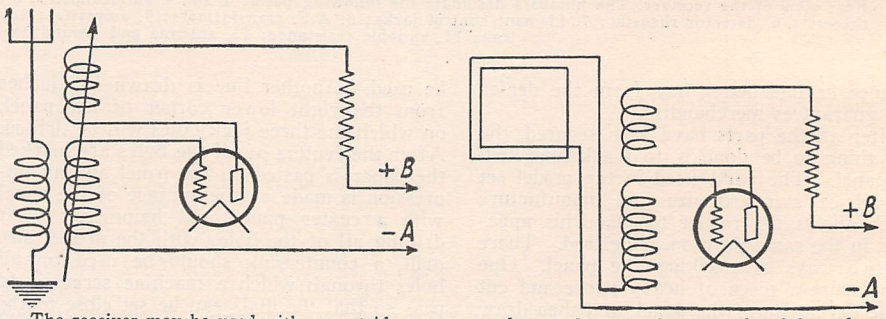
Constructional details of the variocouplers employed. The primary is wound directly over the secondary, separated from it by a layer of cambric cloth. It is best to purchase a variocoupler similar to the type shown and rewind it as specified.

either before or after the panel is drilled, preferably before.

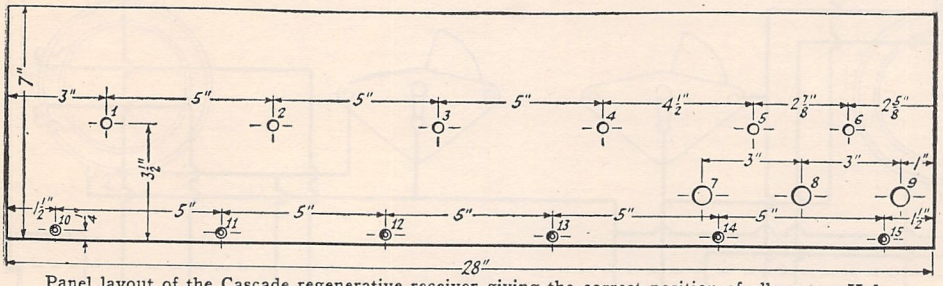
The baseboard should be about three-fourths inch shorter than the panel so that it will fit into the cabinet. It should be the first thing to be fastened. The condensers, variocouplers, rheostats and jacks should be fastened to the panel before the sockets, transformers and other apparatus are fastened to the baseboard. The sockets and other parts should be so placed that the leads are as short as possible at the same time the plate and grid leads should be placed as far apart as possible to avoid unnecessary feedback. Where it is possible, have wires cross at right angles. If two leads come very close together, a short length of combric tubing should be used. All contacts which are not made with machine screws should be soldered. All excess flux should be scraped or washed off with alcohol to avoid corrosion. Filament control jacks are used throughout so as to have the least number of controls possible. The filament of the audio frequency amplifying tubes are controlled by automatic resistances made for use with any particular type of tube. The kind used in this set allow one-fourth ampere to pass to a five-volt tube from a six-volt storage battery, thus only UV-201A tubes or others with a similar current rating can be used. The six ohm rheostat is for use with the two radio frequency tubes while the 20 ohm rheostat supplies the current for the detector tube.

The couplers are both alike as to size and windings. They may be made with any 180 degree variocoupler form. It will usually be much more efficient to buy a form than to make one. Perhaps there are two couplers which are similar in size and shape around the workbench for which there is no further use. The old primary winding should be removed and in its place 40 turns of No. 24 D. S. C. wire should be wound. Directly on top of this winding a strip of cambric cloth should be wound, over which 7 turns of the same size wire is placed. A light coating of radio cement will hold these windings in place. Each loose end should be fastened to a bindinig post placed along the edge of the secondary tube. The wire on the tickler coil probably can be left as it is, but in case there is not enough for regeneration, about 40 turns of No. 24 S. S. C. wire should be added. All three coils should be wound in the same direction. If care is taken in securing two couplers of the same size and provided the respective winding on both couplers are alike, then the dial readings of both condensers should be alike if the condensers are of the same make and same size. The two ticklers should also have approximately the same readings.

After the wiring is complete the filament battery should be connected and a tube placed in each socket. When the phone plug is placed in the first jack, turn on the left rheostat. The two radio frequency tubes should light while the detector tube should light when its rheostat is turned on. When the phone plug is withdrawn from the first jack, these tubes should go out. When putting the plug in the middle jack the radio frequency tubes, the detector tube and the first audio frequency tube should light while the third jack should light all five tubes. As the filament wiring is quite complicated it is fairly easy to make a mistake wiring the jacks, so be careful. The aerial and ground wires as well as the "B" batteries should now be connected. When the phone plug is thrust into any jack, a click should be heard in the phones. Set the two variocoupler dials at about 40 degrees and move the two condenser dials slowly with approximately the same reading for each. A whistle should be heard as a carrier wave is picked up. If no whistle is heard, but a station is heard, try turning the ticklers and if the signal becomes louder as the coupling is decreased then the connections of the tickler which acts in this manner should be reversed. If a buzzing sound is heard there is probably some grid connection open or the variable resistance is open. If the former are perfect, try tightening up the latter.



The receiver may be used with an outside antenna and ground or, as shown at the right, a loop may be employed by connecting it in series with the secondary. Both arrangements work exceedingly well. The use of an outdoor aerial of fair dimensions will, of course, produce the best results.



Panel layout of the Cascade regenerative receiver giving the correct position of all parts. Holes 1, 2, 3, 4, 5 and 6 are ¼ inch; 7, 8, 9 are ½ inch and 10, 11, 12, 13, 14, 15, are ⅛ inch and countersunk.

Radio In South America

By JOHN ENGLISH

THE station of the "Radio Argentina" Company, which for some years has been broadcasting opera from theatres in Buenos Aires, has now increased its power to 1,500 watts. The station will give preference to the operas from the Colon theatre When this house is not giving performances, arrangements have been made for the programs of other theatres to be transmitted, as well as concerts and lectures. In all cases transmission will be direct from the auditoriums. The present wave is 400 meters, but there is some likelihood of a change in the near future. This station transmits its call-letters "LOR," together with other details such as the opera being performed, name of theatre, and name of the company operating the transmitter, in Morse code, four or five times during the evening, using I.C.W. (buzzer-modulated), in order to make it easier for distant listeners to identify the station.

KDKA ON SHORT-WAVE

A program from the KDKA short-wave station was rebroadcast on June 24 by station LOZ, at Monte Grande, near Buenos Aires. The use of this short wave-length also made it possible for the Democratic Convention to be heard nightly, both in the Argentine and in Chile. As a result, interest in the short waves is increasing.

The broadcast station "CRC," at Santiago, Chile, has been allowed to put microphones, not only in the principal theatres, but also in one of the most important churches of the city. This is believed to be the first time that transmissions from a Roman Catholic church have been permitted in South America. This station also caters to all tastes by broadcasting, after the church service, "tips" for the horse races of the Sunday afternoon, and descriptions of these races as they take place. The station is

(*Continued on page* 846)

The "Z" Circuit

By S. D. COFFMAN

A new and ingenious system of resistance coupled radio frequency amplification in which the vacuum tubes are employed as the resistances as well as the amplifiers. The salient feature is the minimization, if not the elimination of foreign noises and distortion. The system has been tried out in the RADIO NEWS *Laboratories and the results were highly satisfactory.*

EVER since the first Radio Program was broadcast and even before, radio engineers searched for that circuit or combination which would give maximum signal intensity with a minimum of distortion.

It is a generally conceded fact amongst these engineers that the well known resistance coupled amplifier gives the minimum of distortion for both radio frequency and audio frequency amplification, providing the circuit is laid out with care and strict adherence to the principles governing the construction of such apparatus.

In the "Z" Circuit another step has been taken toward the ultimate, and maximum amplification has been added with no tendency toward distortion. Ordinary variable resistances of the order used for plate resistors in a resistance coupled amplifier are unsatisfactory owing to variations due to imperfect contact resistance and smaller though troublesome variations due to temperature changes. These variations in resistance, when at all rapid, manifest themselves by scratching and scraping noises in the audio circuit, very similar to static. If the variations are an appreciable percentage of the overall plate-filament impedance, a loss of signal strength results.

From the foregoing it may be seen that it is a difficult matter to maintain an unvarying resistance of a high value even though the current be infinitesimal.

CARE IN CONSTRUCTION

While most tubes have nearly the same characteristic—that is, any particular type of tube—it must not be forgotten that in a radio set where maximum amplification and minimum distortion are to be expected the word "nearly" must be omitted from the builder's vocabulary. Since the characteristic of a vacuum tube is only a slightly variable quantity we must turn to other means of obtaining the proper relation between the grid and plate impedances and the coupling units where the tubes are to be used in cascade.

The vacuum tube comes to the rescue and we have a very flexible resistance which may be varied through a wide range, the values remaining absolutely constant for a given filament emission, neglecting local action on the filament due to impurities in the metal. Local action however, is a very rare occurrence.

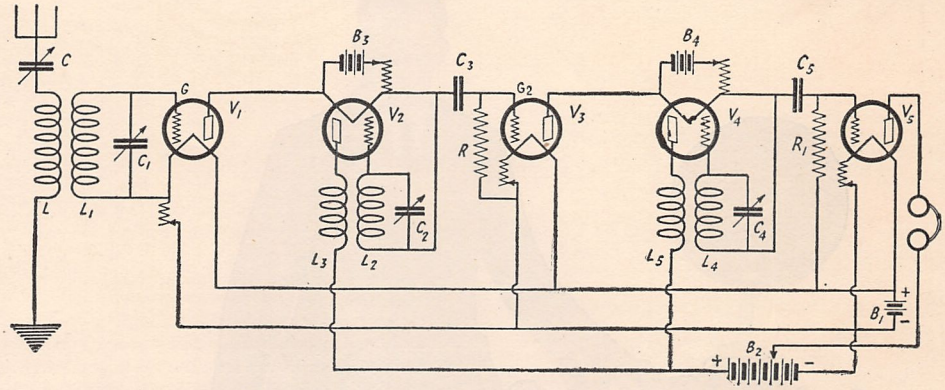
No attempt will be made to give constructional details. Once the fundamental action is understood the circuit may be laid out in various ways with the usual care exercised to minimize unwanted plate-grid feed-back and feed-back between tubes which promotes undesirable inter-oscillations.

The tuning circuit may be either a single circuit affair or, preferably, a coupled one, L L 1, as shown in the schematic diagram. The energy is fed into the first radio frequency tube in the usual manner.

The coupling tubes V_2 and V_4 play a dual role of ordinary coupling resistances and amplifiers. The total for the five tubes is four radio frequency stages and detector.

The plate current of the first tube V_1 is fed through the plate filament circuit of coupling tube V_2 and the inductance L_3.

The grid circuit of coupling tube V_2 contains an inductance L_2 tuned to the desired



A truly excellent system of resistance coupled amplification wherein the vacuum tubes play the part of both the resistances and the amplifiers. The system is not confined to the circuit only, it can be adapted to various circuit arrangements.

signal and inductively coupled with L_3. The action is to raise or lower the impedance of tube V_2 depending upon the sign. Starting with a positive impulse on grid G the plate current of tube V_1 would, of course, rise. A corresponding change takes place through the plate filament circuit of tube V_2, the variations of which about the mean govern the potential of grid G_2 of tube V_3. Since the grid circuit of tube V_2 contains an inductance which is inductively coupled with the plate circuit of the same tube, it may be seen that with the proper relation between L_2 and L_3 as to sign, the plate current of this tube will rise still higher, if the grid is swung positively. A reverse action will occur when grid G of tube V_1 receives a negative impulse. The action in each case being cumulative, great amplification is obtained.

Proceeding to tubes V_3 and V_4 the same action occurs as in tubes V_1 and V_2.

THE DETECTOR

Tube V_5 is a straight detector with no changes from the conventional except that the grid leak must go to the filament direct. Of course, audio frequency amplification may be used if desired.

Adjustment of the filament emission of the coupling tubes is the same as adjusting a variable resistance but with the advantages as stated before. It will be found when the filament emission is low that the signal intensity will be small. As the filament becomes brighter the signal will increase to a definite peak value and then drop off as the emission is raised above the optimum value. This is due to two factors. First, there is a definite value of emission for the proper impedance fit for the plate circuit of tube V_1 and also that the limiting action of the coupling tube is at a minimum at the optimum filament emission.

Filament batteries B_3 and B_4 are isolated as shown, the voltage depending upon the type of tube used. As in all resistance coupled amplifiers the voltage of the "B" battery must be higher than in the ordinary tuned plate type or other style circuits. The exact plate potential required will vary with the type of tube used.

The high degree of amplification and clarity of signal obtained with this circuit is truly remarkable. The construction is well within the scope of the average experimenter.

YOUR CAR!

Are you interested in motoring, touring or camping? If you are, do not fail to read the November issue of

MOTOR CAMPER AND TOURIST

Here is a magazine that tells you things in connection with your car—things that you never even suspected.

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CONTENTS FOR NOVEMBER ISSUE

Camp Cookery, Jessie Call
Diary of An Automobile, Elizabeth Gwynne
First Aid for Tourists, C. P. Fordyce, M. D.
Tips for Tourists, Raymond S. Spears
Do Strange Cities Puzzle You? Frederick R. Russell
The Indian Ladder, Emma W. McNeil
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Don't Forget the Battery, C. C. Hermann
Uncle Sam Seeks Water for Desert Tourists, Geo. H. Dacy
How to Find Your Way by the Stars, I. M. Lewis
Atlantic to Pacific National Highway, John D. Long Hitchcock
Fashions for November Tourists, Mrs. Sherman
Indian Teepe Tent, Major Chas. G. Percival
Blind, Deaf and Dumb Touring, Lewis L. Thomas

D.C. FROM AN A.C. SOURCE

The readers of RADIO NEWS will be interested in a general description of a new device for supplying filament, plate and grid-bias potentials to vacuum tubes from A.C. supply.

It operates on the thermo-electric principle. From this fact it derives the name "Thermoformer."

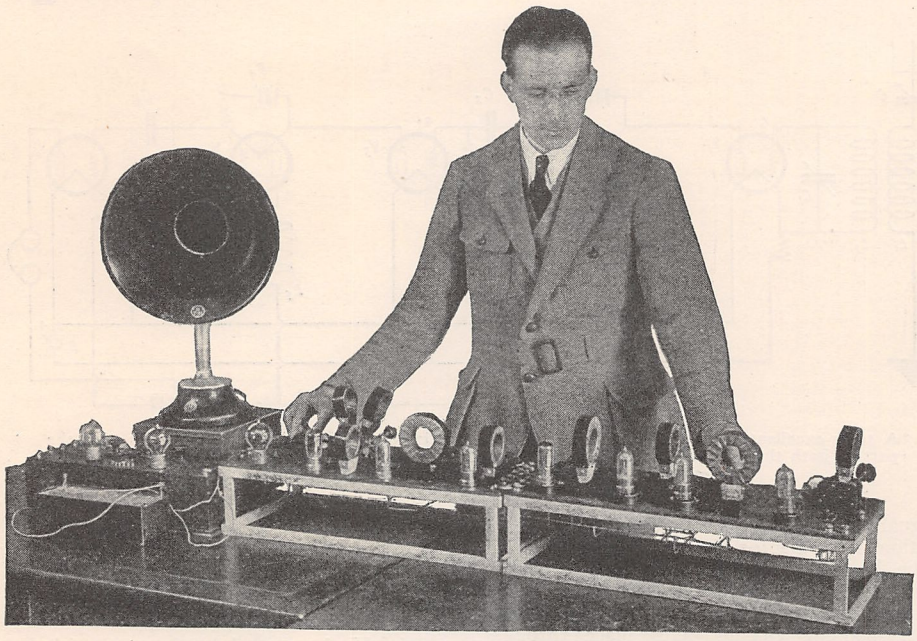
This is in the form of a heating unit (greatly resembling an electric toaster) placed close to a series of pairs of dissimilar metals. It is well known that such an arrangement of a heating unit and dissimilar metal couples will cause a current of

(*Continued on page* 792)

Multi-Stage Radio Frequency Amplification

By JOHN SCOTT-TAGGART, F. Inst. P. A.M.I.E.E.

To our readers who are interested both in experimentation and the reception of signals over long distances this article, one of the most comprehensive ever published in connection with such an important subject, will prove invaluable.



The author experimenting with a ten tube multi-stage radio frequency receiver. The system employed is fully covered in this article.

THE achievement of long distance reception is closely bound up with efficient radio frequency amplification. Rarely, however, is any trouble experienced when only a single stage of such amplification is used. On the other hand, whenever two or more stages are employed, the apparently straightforward process of simply adding extra tubes brings in its train complications which interfere with the whole action of radio frequency amplification.

In some quarters we frequently see several tuned plate circuits connected in cascade with delightful abandon, but everyone who has tried to arrange such circuits has found that they are completely unworkable. Oscillation will inevitably be set up, and once an amplifying arrangement is oscillating it is practically useless for radio reception.

The effective amplification of radio frequency currents of high frequency, such as those employed for broadcast transmission, is inevitably bound up with the use of tuned circuits in the intertube couplings. These tuned circuits are responsible for the tendency which all radio frequency amplifiers have to oscillate, but, on the other hand, the use of a tuned circuit results in all the beneficial building up of oscillations given by resonant phenomena. We can, of course, dispense with tuned intertube couplings, using untuned transformers, but although great stability may be obtained with such arrangements, the sensitiveness is small and a very large number of tubes are required to give a result which may be more easily obtained with one or two stages of efficient tuned radio frequency amplification arrangements. An aperiodic radio frequency amplifying system gives such inferior results on short wave-lengths that it is not proposed to deal with such arrangements in this article.

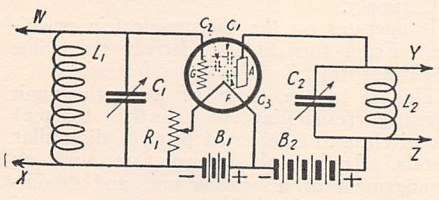


Fig. 1. Circuit diagram of the simplest form of radio frequency amplifier.

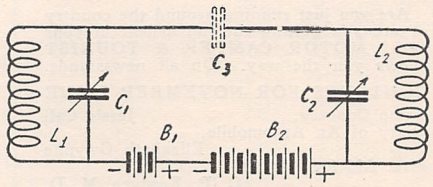


Fig. 2. The circuit of Fig. 1. reduced to the technical equivalents of the instruments.

THE SIMPLE CIRCUIT

The simplest form of amplifying circuit using a tube for the amplification of radio frequency currents, is that illustrated in Fig. 1. We have an oscillatory circuit L_1, C_1, in the grid circuit of a tube V. It will be seen that one side of the circuit L_1, C_1, is connected to the grid G, and the other side to the negative terminal of the "A" battery B_1; a rheostat R is included in the negative lead to the filament, this resulting in the grid being given, via L_1, a negative potential corresponding to the potential drop across the used portion of the rheostat R. This negative potential will usually be in the neighbourhood of 1 or 2 volts, and serves to prevent the establishment of any appreciable grid current in the grid circuit of the tube. Such a grid current would introduce damping into the grid circuit and so lessen the potentials established across the grid and filament of the tube. The plate circuit of the tube contains the plate A, the tuned circuit L_2 C_2, and the "B" battery, or plate battery, B_2. A condenser of, say, 0.002 mfd. capacity may be connected across B_2 to act as a by-pass for the radio-frequency currents in the plate circuit, but in practice, this is unnecessary, and from the radio frequency point of view, the battery B_2 may be regarded as merely a continuation of the wiring to the filament, from the circuit L_2 C_2.

In this simple amplifying arrangement it is supposed that energy is fed into the circuit L_1 C_1 from some source to the left of the circuit. In ordinary cases this source of input energy will be an aerial, or equivalent system, or the plate current of a preceding radio frequency amplifying tube. Likewise, the amplified oscillations established across the circuit L_2 C_2 will be communicated, either to a detector, or to another stage of radio frequency amplification. We are therefore principally concerned with the ratio of the E.M.F.'s across W X, and those across Y and Z. It is our object to obtain the highest possible E.M.F.'s across Y Z without the tube V passing into oscillation.

If such a circuit is arranged, it will be found that unless there is a heavy load on the circuit L_1 C_1, or the circuit L_2 C_2, that when the two circuits are tuned to the same wave-length, the tube will generate continuous oscillations of its own accord, and the merit of the arrangement as an amplifier of externally applied radio frequency currents, will be ruined.

This self-oscillation effect is due to a feed-back effect which is carried beyond the stable condition, and is due to a transference of the amplified energy in the output circuit of the tube, L_2 C_2, to the input circuit, L_1 C_1. To prevent self-oscillation of a tube we have to prevent a transference of energy from the output circuit to the input circuit.

This transference of energy is accomplished by two forms of coupling:—

1. Capacity coupling between one circuit and the other.
2. Inductive or magnetic coupling between the inductance in the plate circuit and the inductance in the grid circuit.

CAPACITY COUPLING IN A TUBE

Capacity coupling between the plate circuit of a tube and the grid circuit, is responsible for probably at least 80 per cent. of the undesirable self-oscillation of radio frequency amplifiers.

This capacity coupling is effected in two different ways which, however, both act in the same direction to produce self-oscillation.

These forms of capacity coupling are due:—

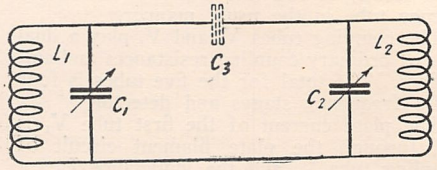


Fig. 3. Still the same circuit of Fig. 1. but devoid of potential and current sources.

1. To the interelectrode capacity of the tube, *i.e.*, the capacity formed by the grid and plate of the tube, and the capacity between the grid and plate valve prongs and sockets, and wires going to these points.

2. The capacity coupling between the inductance coils themselves.

There is a tendency to blame the capacity between the grid and plate of a tube to almost too great an extent, and insufficient attention is paid to the other capacities which act in parallel with the condenser action of the tube itself.

In Fig. 1 I have shown three small phantom condensers C_1, C_2 and C_3, (shown in dotted lines) which are intended to indicate the distributed capacity between the grid and the plate. The grid, of course, is usually in the form of a spiral wire concentric with a cylindrical plate. The result is that the grid acts as one plate of a very small condenser and the plate as the other plate. The grid and plate inside the tube therefore act like a condenser, and this condenser couples the circuit L_1 C_1 to the circuit L_2 C_2 by ordinary capacity coupling.

The grid has also a capacity with respect to the filament, the grid forming one side of a still smaller condenser, and the filament the other side. This capacity, although playing a part in the process of radio frequency amplification, may conveniently be left out of consideration, at the present stage, for the sake of simplicity. Likewise, the capacity between the plate and the filament may, at this stage, be left out of consideration.

If we simplify the circuit shown in Fig. 1, regarding the tube merely as a means of coupling one circuit to the other by a capacity coupling, we arrive at Fig. 2. Here, the batteries B_1 and B_2 serve to give a direct connection from the foot of L_1 C_1 to the foot of L_2 C_2, while the condenser C_3, in dotted line, represents the capacity between the grid of the tube and the plate. The batteries B_1 and B_2, having negligible resistance and impedence, do not in any way affect the radio frequency aspects of the circuit, and we can consequently simplify the Fig. 2 arrangement as shown in Fig. 3.

This figure will be recognized as one of the standard methods of coupling two tuned oscillation circuits together. Such circuits may always be coupled together by means of inductive capacity or resistance coupling, and Fig. 3 is a typical method of coupling two tuned circuits together by means of a condenser. Sometimes the condenser is inserted between one end of one circuit and one end of the other, and another condenser between the other end of the first circuit and the other end of the second circuit; two condensers, however, are not required provided two ends of the respective circuits are directly connected.

In the Fig. 1 arrangement, the oscillations in L_2 C_2 are, due to the amplification of the tube V, very much stronger than the oscillations in the circuit L_1 C_1; we are therefore concerned with the feeding-back of radio frequency energy from the circuit L_2 C_2 to the circuit L_1 C_1. This energy is fed back to the capacity between the grid and plate of the tube, *i.e.*, through the condenser C_3 in Fig. 3. Provided the phase relationship between the oscillations in L_2 C_2 and L_1 C_1 is correct, the tube will generate continuous oscillations.

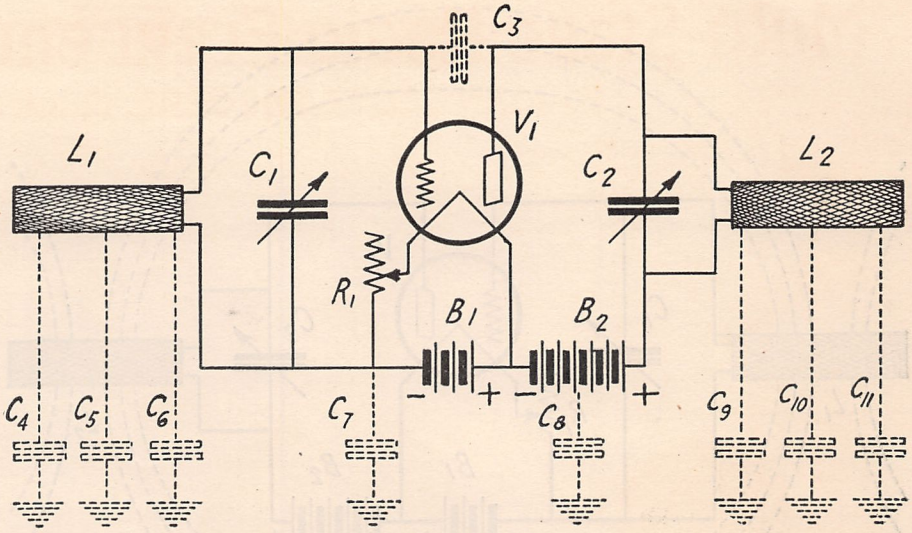


Fig. 5. Illustrating the capacity effect existing between instruments in the receiver and earth.

BOTH CIRCUITS MUST BE TUNED

It is, however, important to appreciate that energy will not be transferred from the circuit L_2 C_2 to the circuit L_1 C_1 unless both circuits are approximately tuned to the same wave-length. If, for example, we detune L_2 C_2 so that the wave-length of this circuit is less, or greater, than that of the circuit L_1 C_1, the tube will remain stable, and not only will it not oscillate, but it will not amplify. Slight variations in the tuning will cause variations in the tendency of the tube to oscillate, and if the tendency is too great, a detuning of one of the condensers C_1 C_2 will render the apparatus stable. The ideal state of affairs is to have both circuits exactly tuned to the wave-length of the signals to be amplified. If it is necessary to detune one of the circuits to prevent self-oscillation of the tube, the degree of amplification will be reduced, and if the variation is made too great, the amplification effect will be nil. Moreover, the detuning of one of the circuits may result, in the case of a radio receiver, in some other station being picked up, and in any case, the adjustments at the self-oscillation point may cause a great deal of interference with neighboring sets owing to the radiation of the continuous oscillations set up by the tube.

Fig. 4 shows the various capacities involved in a radio frequency amplifier. It will be seen that there is a capacity C_3 which acts between the grid and plate of a tube while there is also a capacity effect directly between the plate A of the tube and the filament F; this capacity is represented by C_5 in Fig. 4. The capacity C_5 The capacity C_5 acts in parallel with the capacity C_2, the battery B_2 not interfering with the action of the oscillatory current, as has already been explained. Apart from the capacity C_5, we may also consider the plate to filament path of the tube acting as two capacities in series. These would be the only capacities if the grid were solid, and the two capacities C_3 and C_4 therefore, while acting in series with each other, are jointly in parallel with C_2, and therefore any oscillations in L_2 C_2 will set up varying potential differences across both C_4 and C_3. The potentials across C_4 will be communicated to the circuit L_1 C_1, so that, in effect, the grid to filament capacity also contributes to the passing on of energy from the plate circuit to the grid circuit. This aspect seems to have been neglected in previous discussions, but the fact remains that the essential coupling medium between the plate and grid circuits of the tube is the grid to plate capacity inside the tube and the capacity between the leads going to these electrodes and the capacity inside the tube holder and cap.

The separation of tube sockets and the plate and grid leads in a set will go far toward the reduction of tube capacity and the consequent self-oscillation.

CAPACITY BETWEEN COILS

There appears to be an almost total neglect of an important cause of self-oscillation in radio frequency amplifiers. Although attention is regularly given to the capacity inside the tube, yet a capacity effect which is often very many times greater is that between inductance coils in the circuit. This trouble, of course, is worse when the inductance coils are of large size, but the effect is also very noticeable even on broadcast wave-lengths. Sometimes the capacity is directly between one coil and another, but if coils are placed well apart direct capacity coupling is small.

What usually happens is that each coil has a substantial capacity to some common conductor; for example, each coil possesses a certain capacity to earth, the word earth also implying wiring which is connected to the filament battery and high tension battery which, being substantial masses, have a relatively large capacity to earth, and the direct capacity effect between the coils and such batteries, transformers, variable condensers and other pieces of apparatus inside a set which have substantial capacity to earth and to each other. All these

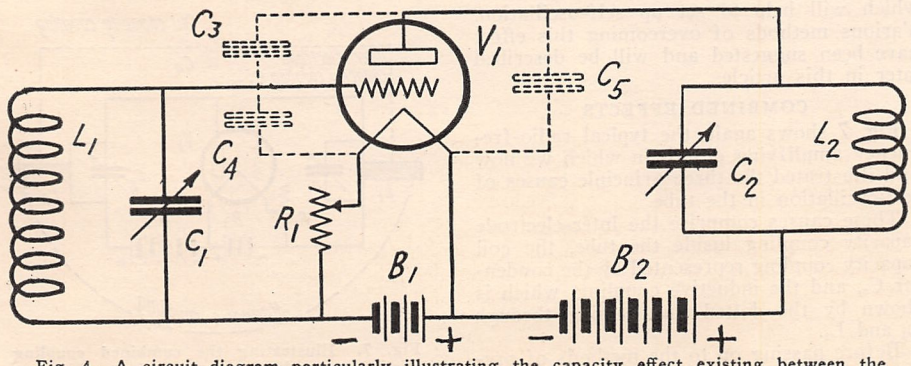


Fig. 4. A circuit diagram particularly illustrating the capacity effect existing between the elements of the vacuum tube.

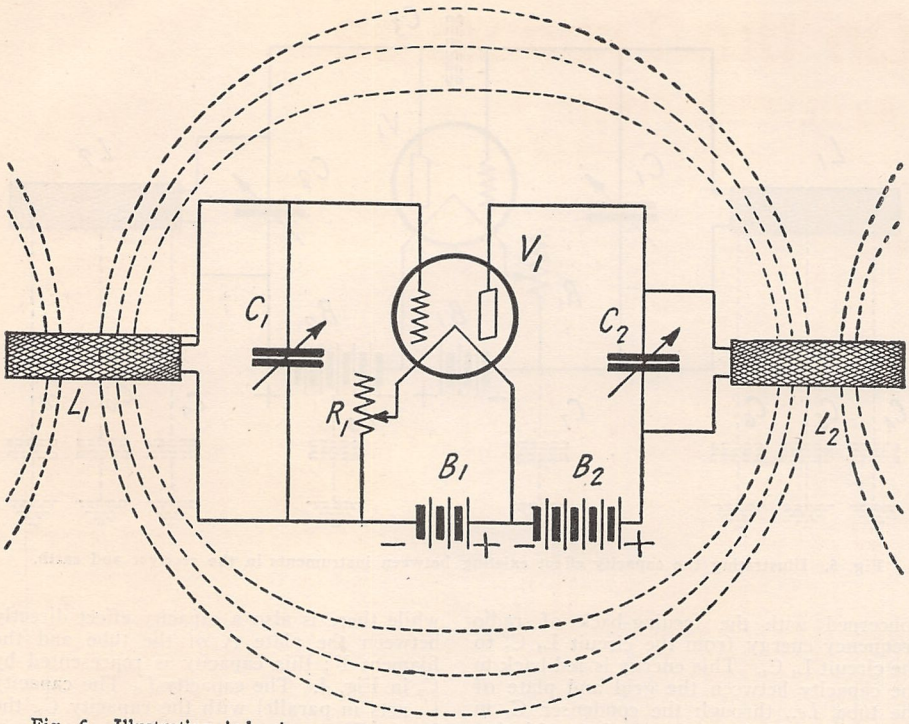


Fig. 6. Illustrating inductive coupling; the magnetic fields of two adjacent coils linking together.

capacities add together to couple the two oscillatory circuits and their joint effect is frequently very much greater than the actual capacity between the grid and the plate.

EFFECT IN TRANSFORMERS

Where there is transformer coupling in a radio frequency amplifier the inductances in the grid and plate circuit of a tube, respectively are coupled to windings which have one end connected either directly to the filament, or through a "B" battery which does not affect radio frequency considerations. The result is that the capacity between the primary and secondary windings of each of the high frequency transformers may be considerable, and will really amount to a coupling between the grid inductance and the plate inductance. This aspect of radio frequency transformers is, again, a point which seems to have been overlooked by writers on the subject, and the moral, of course, is to use loose coupling between the primary and secondary windings of radio-frequency transformers, if these are to be used.

EFFECT OF CONDENSERS

Variable condensers are also very troublesome in supplementing the capacity coupling between grid and plate circuits of a tube. If, in Fig. 5, the variable condenser C_1, is placed close to the variable condenser C_2, it will be obvious that there will be a substantial capacity coupling between the upper plate of C_1 and the upper plate of C_2, *i.e.*, the plates which vary a radio frequency potential with respect to the filament. Since the upper plate of C_1 is connected to the grid and the upper plate of C_2 is connected to the plate of a tube, we have this capacity coupling adding itself to the capacity C_3 between grid and plate of the tube itself. The moral here, of course, is to separate the variable condensers as far as conveniently possible, because they are a great source of self-oscillation in radio-frequency amplifiers, although many experimenters imagine that if they separate the coils and take other precautions, such as the keeping of all wiring separate, no serious trouble will be experienced. On the other hand, the position is that however careful one may be, in certain directions, the placing of variable condensers fairly close to each other will nullify all the other precautions and cause serious self-oscillation tendencies in the amplifier.

INDUCTIVE COUPLING AS A SOURCE OF SELF-OSCILLATION

We now come to the question of inductive coupling in radio frequency amplifiers. Fig. 6 shows a simple radio frequency amplifying system in which two honeycomb coils L_1 and L_2 are included, respectively, in the grid and plate circuits of the tube.

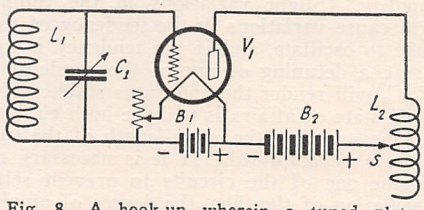


Fig. 8. A hook-up wherein a tuned plate circuit is incorporated.

The dotted lines indicate the magnetic linkage, or inductive coupling, between coils L_1 and L_2, and this coupling may be in such a direction as to produce a regeneration effect which, either by itself or in combination with the capacity feed-back effect, may set up oscillations. On the other hand, of course, the coupling between the coils may be such as to tend to decrease a tendency to self-oscillation, and in some receivers the coils are arranged to produce this effect. Usually, however, the proximity of inductance coils leads to an inductance feed back which will help to set up self-oscillation. Various methods of overcoming this effect have been suggested and will be described later in this article.

COMBINED EFFECTS

Fig. 7 shows again the typical radio-frequency amplifying circuit in which we now find illustrated the three principle causes of self-oscillation in the tube.

These causes comprise the inter-electrode capacity coupling inside the tube, the coil capacity coupling represented by the condenser C_5, and the inductive coupling, which is shown by the dotted line passing through L_1 and L_2.

Before passing on to the methods of preventing self-oscillation in a radio frequency amplifier, it would be as well to examine another aspect of the conditions under which self-oscillation may occur.

THE TUNED OR APERIODIC PLATE CIRCUIT

We have so far considered the simple circuit where the grid and plate circuits have been tuned to the same wave-length. Under these conditions it has been explained that a tube will tend to oscillate, provided the tube is a sufficiently good amplifier.

We meet, however, with a large number of circuits in which the grid or plate circuits are not tuned. Frequently one of the circuits is tuned and the other is not.

This type of circuit generally has less tendency to produce self-oscillation than a circuit in which there is a tuned grid and tuned plate circuit.

We, however, sometimes have a circuit of the kind shown in Fig. 8, which, while not possessing an obviously tuned plate circuit, may, in reality, comprise an equivalent arrangement. In Fig. 8 it will be seen that the plate circuit includes the inductance L_2, which is variable. It will be found that by sliding the contact S from the top to the bottom and measuring the output E.M.F.'s across the used portion of L_2, that, at first, there is, to all intents and purposes, no amplification at all. A point, however, is reached when sufficient inductance is included in the plate circuit of the tube when a very decided amplification is obtained. As the inductance is increased still further, a point of maximum amplification is reached, and after that the amplification falls off a little, although a large amount of inductance may be included in the plate circuit of the tube.

The absence of a condenser across the used portion of L_2 might suggest, to the beginner, that there is no tuning in the plate circuit of the tube and that the coil was, therefore, aperiodic. This, however, is not strictly true; the used portion of the coil L_2 will really have in parallel with it the self-capacity of the inductance itself, the capacity between plate and filament of the tube, and the capacity of the coil to earth.

Fig. 9 shows the self-capacity of the coil C_2 and the plate to filament capacity C_4. These two capacities assist in producing a tuned plate circuit in which, however, the parallel capacity is very small. If the particular value of the inductance in the plate circuit of a tube is so chosen that what is sometimes known as the natural wave-length of the coil is equal to the wave-length to which the grid circuit is tuned, the tube will tend to oscillate and will probably do so.

If, however, the inductance is increased so that the natural wave-length is higher than the wave-length to which the grid circuit is tuned, the tube will continue to act as a radio frequency amplifier, although there will not be a tendency towards self-oscillation. The so-called aperiodic output coil, in which the only capacities are those just mentioned, does not produce selective amplification, as in the case of the tuned plate cir-

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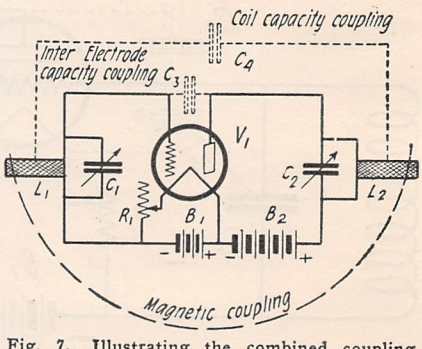


Fig. 7. Illustrating the combined coupling effects in a radio frequency circuit which are responsible for oscillation in the tube.

Notes On the Tropadyne

By CLYDE J. FITCH

Since the appearance of the Tropadyne circuit, letters have been pouring in from all over the country asking for further information. In the following article Mr. Fitch has attempted to answer the more interesting questions. Slight improvements that have been made since the original receiver was constructed are also given.

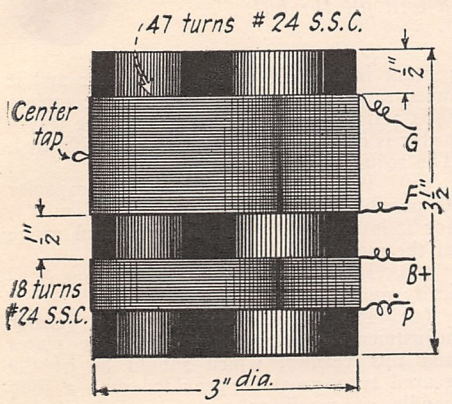


Fig. 1

Oscillator coil for the tropadyne to be used with a 23-plate condenser.

WE have received so many inquiries regarding the Tropadyne receiver described in the August issue of RADIO NEWS that we have decided to publish some of them, which will be of general interest to our readers. Whether or not you intend to build a Tropadyne, you should read the article as it pertains to Super-Heterodynes in general.

As the Tropadyne receiver described in the August issue employs a 23-plate (.0005 mfd.) condenser for the tuner and a 43-plate (.001 mfd.) condenser for the oscillator, many experimenters, who already have Super-Heterodynes of other makes employing two 23-plate condensers, requested the design of an oscillator coil which could be used with a 23-plate condenser. This they desire in order that they could easily change their Super-Heterodynes into Tropadynes. Fig. 1 shows an oscillator coil which may be used with a 23-plate condenser in the Tropadyne. On a 3-inch diameter bakelite tube 3½ inches long wind 47 turns of No. 24 S. S. C. wires, starting ½ inch from one end. A tap is taken at the exact center, which would be 23½ turns from either end. One-half inch from this coil wind 18 turns of the same sized wire in the same direction. The terminals are lettered in Fig. 1 and the coil is connected as shown in the August issue. It will cover the broadcast wave-length range when used with a .0005 mfd. 23-plate condenser.

Many questions were received regarding the tuned intermediate transformers, or Tropaformers. Those who attempted to wind the coils found that when the correct number of turns were in place the finished coil was not 1⅝ inches in diameter as it should be. This was due to the fact that they used less insulation between layers and more turns per layer. Although the coils are ⅜ inch wide, the layers are not that wide, as they are held in place by ⅜-inch strips of the paper insulation between the layers.

These transformers have been improved and simplified, as shown in Fig. 2. By making the coils ⅝ inch wide, only two are required, one primary and one secondary, with 500 turns on the primary and 1,000 on the secondary, giving a 2 to 1 ratio. The core is made ¼ inch thick instead of ⅜ inch.

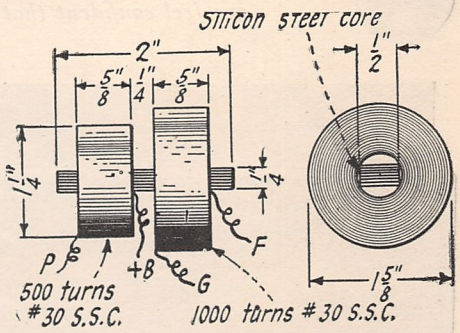


Fig. 2

Improved construction of the intermediate wave radio frequency transformers.

Numerous experiments were conducted with this transformer. With more iron in the core the tuning was broader. Placing the two coils close together also broadened the tuning. Without the iron core the amplification was about half that obtained when using it. A happy medium was found by spacing the coils ¼ inch and using the amount of core shown. This makes the tuning broad enough to pass the side bands and at the same time prevent distortion. By tuning the secondaries with variable condensers each transformer is properly matched and maximum amplification is as-

(*Continued on page* 740)

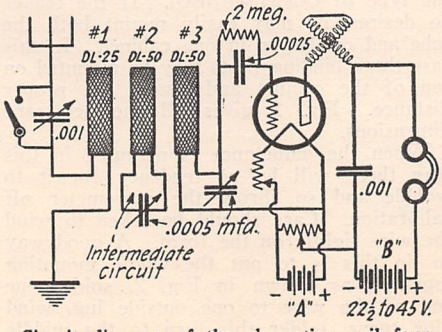
An Absorption Coil Four Circuit Tuner

By EDWARD H. LERCHEN

ABOUT two years ago the author developed a circuit known as the "Double Feedback Regenerative Tuner" and many thousands of radio fans constructed sets after the description given and obtained wonderful results, as shown by the many letters received from all parts of the world. Since that time he has been experimenting, looking toward the elimination of defects in present-day regenerative tuners. The Absorption Coil Four Circuit Tuner is the outcome of his work along these lines. It will prove of considerable interest to those searching for a circuit devoid of the disadvantages present in the common forms of regenerative tuners.

As shown by the accompanying drawings, it will be seen that the principal and radical change from most tuners is the addition of an isolated circuit consisting of a coil (preferably of the honeycomb variety) and a variable condenser. This is the absorption circuit and is not directly connected to either of the other circuits. This isolated circuit, as seen from the diagram, is interposed between the primary and secondary coils of the tuner. Regeneration is accomplished by a variometer in the plate circuit of the vacuum tube. Note the designations. Circuit No. 1 is the primary or aerial circuit, Circuit No. 2 is the absorption circuit, while No. 3 is the secondary circuit and No. 4 the plate circuit. All of the instrument values are given in the diagram but following is a list of the parts necessary for constructing a set of this type:

1 Three-coil honeycomb coil mounting.
1 DL-25 coil.
2 DL-50 coils.
1 Low loss .001 mfd. (43 plates) variable condenser.
2 Low loss .0005 mfd. (23 plates) variable condensers.
1 Switch for cutting out antenna con-



Circuit diagram of the absorption coil four circuit tuner described in this article.

denser to make primary operate aperiodically.
1 Large type variometer for the plate circuit.
1 400-ohm potentiometer.
1 Rheostat (6 or 30 ohms, depending upon tube used).
1 Tube socket.
1 .00025 mfd. grid condenser with 2 megohm grid leak.

With the components named the circuit will operate on all wave-lengths from 200 to 600 meters. If it is desired to receive on the lower waves two DL-25 coils should be substituted for the DL-50 coils. This will allow the set to tune down to as low as 95 meters when the series antenna condenser is cut into the circuit by the opening of the short circuiting switch. Likewise, to get above 600 meters three DL-75 coils can be substituted.

Within six blocks of Station WAAM, one mile from WBS and two miles from Station WOR, we were able to bring in Philadelphia and Pittsburgh at 8:00 p. m., without interference. This was done by changing the coupling between coil No. 1 and coil No. 3, these being adjustable. Coil No. 2 is stationary.

This is a very simple set to build and when in operation there are really only two controls in use, the two 23-plate variable condensers, and these will both have the same dial setting. It is seldom necessary to adjust the variometer after the highest point of regeneration is found.

This circuit has brought in stations from San Juan, Porto Rico, to Omaha and from Toronto to Florida.

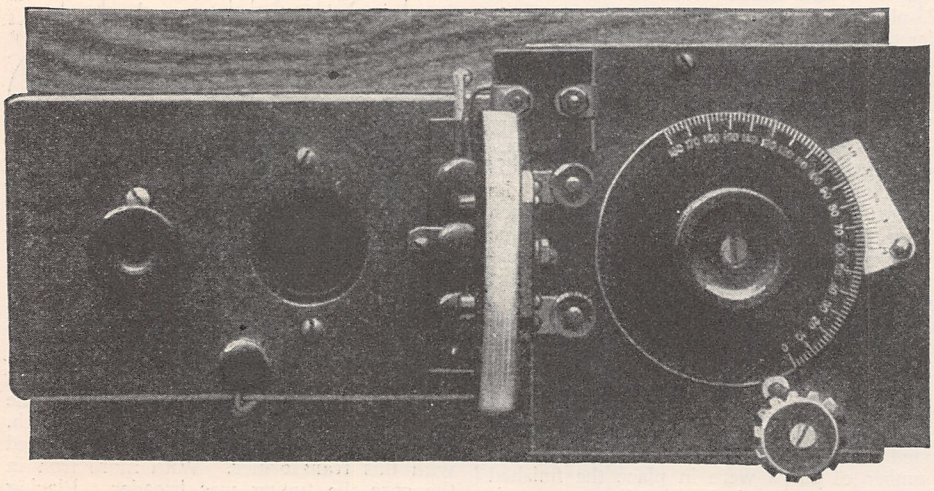
The Heterodyne Wavemeter

By JAMES WOOD, Jr., 2ALG

Design Construction and Calibration

Part I

There is a crying need for a good Heterodyne wavemeter in the station of every amateur and we feel confident that the one described in this article by Mr. Wood will fill the bill.



A top view of the completed Heterodyne wavemeter. The rheostat control knob is to the extreme left, followed by the tube socket, the inductance and the variable condenser. Note the vernier scale attachment on the condenser.

THERE are several facts the experimenter must keep in mind when he desires to construct a wavemeter similar to the one described in this article. In the first place, the instruments used must be sufficiently well made mechanically to retain their constants to a reasonable degree. After this requirement has been fulfilled, the instruments must be so combined that once calibrated, the wavemeter will retain its calibration. The latter requirement is one that will give the prospective builder some trouble unless he takes proper precautions. There is one simple rule that will always solve the problem. The rule briefly stated is this: Fasten everything securely. If this is to be done it becomes apparent at once that the instruments are there to stay and cannot be disconnected, used for some other purpose, and then reconnected to the wavemeter.

INDUCTANCE

The inductance has a value of approximately 36 microhenrys. It may be made by winding 17 turns of No. 28 D.C.C. wire on a form 3 inches in diameter. Some will no doubt condemn the practice of using so small a size as No. 28. It should be remembered, however, that as long as the circuit comprising the inductance and capacity will oscillate throughout the range of the instrument, we need not be concerned with the resistance of the inductance. It is to be noted that an inductance wound with a small sized wire has less distributed capacity than one wound with heavy wire. This is an important point if the wave-length range of the wavemeter is to be a maximum for a given variable condenser. Fig. 2 shows one method of mounting the inductance. The winding form is of wood. It is preferable to use either wood or some good insulating material for the form so as to give the inductance rigidity when it is mounted. It is rather difficult to fasten cardboard securely. The form used by the writer was turned from a wire spool end.

Referring again to Fig. 2, it will be seen that there are three lugs coming from the inductance. The two outside ones are of thin sheet copper or brass, preferably the former. The middle lug is of heavy copper. It serves as the support for the inductance and is connected to the positive side of the filament (see Fig. 1 for connections). The wavemeter will not function satisfactorily when the negative side of the filament is used. The distance between the two outside lugs will, of course, vary with the type of condenser used. If the reader so desires, he may easily mount both the tube and condenser in one cabinet. In this case three binding posts may be mounted on top of the cabinet and spaced the proper distance. Fig. 2 gives all the necessary dimensions.

When the inductance is mounted in this way there will be no tendency for it to wobble and so throw the wavemeter off calibration. Care should be taken to wind the wire tightly on the form. A good way to do this is to put the whole mounting together, as shown in Fig. 2, solder one end of the wire to one outside lug, wind nine turns, solder this turn to the middle lug and then wind the eight turns, soldering the end to the other outside lug. Do not coat the winding with a varnish or cement solution.

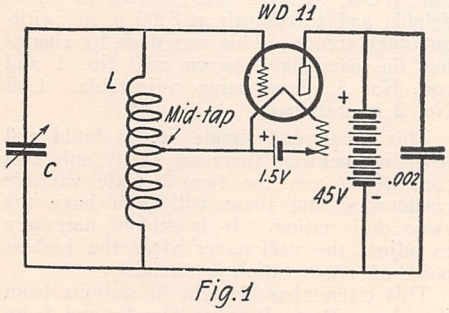


Fig. 1

Circuit diagram of the Heterodyne Wavemeter.

CONDENSER

The condenser is probably the most important instrument of the wavemeter and it must satisfy several requisites if complete satisfaction is to be realized when the wavemeter is completely assembled and calibrated. The requirements are:

(a) It must have as low a zero capacity as possible (not greater than .00002 mfd.), for it is upon this that the minimum range of the meter depends.

(b) It must be well made, both mechanically and electrically.

(c) It must be provided with a vernier adjustment for rotating the movable plates and this vernier, which should be of the geared type, must be provided with a long handle of wood or some good insulating material. The handle should be at least 10 inches long. The photographs show only a short handle for the vernier, but this is not satisfactory. If the hand is brought closer than 10 inches, the frequency of the wavemeter oscillations change appreciably, making accurate adjustment tedious and difficult.

(d) For the utmost convenience, the capacity curve of the condenser should be known preferably to three significant figures (such as .000317 mfd.). This is not absolutely necessary for the most economical method, but is very useful. This will be covered more in detail in Part 2 of this series.

(e) The scale of the condenser should be divided into 180 degrees and should be readable to one degree directly. In other words, there should actually be 180 marks on the scale. A scale with 100 divisions can also be used, but the readings obtained with it will not be as accurate as with the 180 degree scale. A very excellent form of scale is an ordinary draftsman's protractor fastened over the regular dial. It of course becomes necessary to have a flat dial for this purpose. If desired, the protractor can be fastened directly to the knob and the dial dispensed with entirely. There should also be a vernier scale to permit reading to .1 degree. Figures 3a and 3b show what is meant by a vernier scale for those who are as yet uninitiated. To read the condenser equipped with the vernier scale we first read the scale attached to the

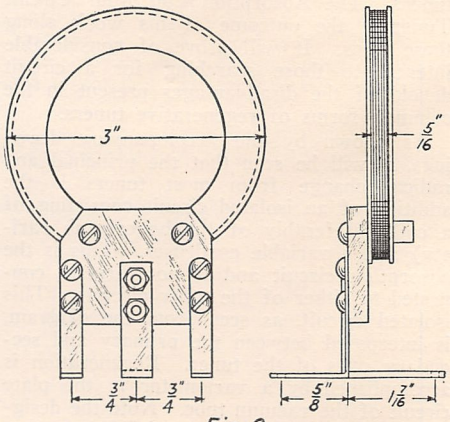


Fig. 2

Constructional details of the wavemeter. Three lugs at the base form the two terminals and the mid-tap of the coil.

knob, considering the zero mark of the vernier scale as the pointer. Suppose this reading to be a little over 61, but not quite 62 degrees (see Fig. 3a). Consulting the vernier scale, we see that the fourth division is parallel with one of the divisions of the main scale, that is, the reading is 61.4 degrees correct to three significant figures. To take another case (see Fig. 3b), suppose again that the zero line of the vernier scale points somewhere between 60 and 61 degrees, but this time let us suppose that the eighth division of the vernier scale is parallel with a division of the rotating scale. This time the reading would be 60.8 degrees. There will always be found one division and only one that is parallel to a division mark on the main scale. It should be noted that it makes no difference which mark of the main scale this is. We are concerned only with the mark on the vernier scale. If the procedure is still not clear, the reader should consult a good physics laboratory manual. It should always be remembered that the vernier scale divides the smallest division of the main scale into as many parts as the vernier itself is divided. It should be noticed that the divisions of the vernier scale are smaller than the divisions of the main scale. In the case illustrated, (n) divisions of the vernier are equal to (n-1) divisions of the main scale. The vernier scale may easily be made by the reader. It is simply necessary to lay out an angle of nine degrees on a suitable piece of material (white celluloid is good) and divide it into 10 equal parts. Lay out the nine-degree angle and bisect it with a compass; draw the bisecting line. Now adjust the protractor so that its 90-degree mark and its center mark on the bottom edge are one, the line bisecting the angle. The protractor is then moved upward, keeping its position on the line, until 10 degrees on the protractor scale just cover the distance between the two sides of the nine-degree angle. The sides of the latter are prolonged if necessary. Mark out the 10 divisions and draw lines through them to the vertex of the angle. When this is done, we have an angle of nine degrees divided into practically 10 equal parts. This method is about as accurate a one as could be used for such a small angle. Great care should be exercised, however, for unless the job is carefully done, measurement by means of the vernier will not be reliable.

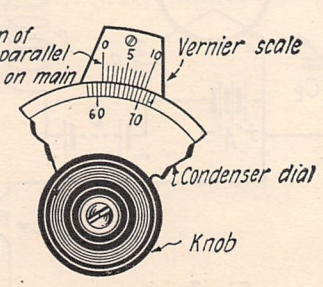
At this point it is well to bring out that the reading of the condenser scale at the lower end will not be as accurate as at the upper end. This is due to the fact that at the lower end the wave-length curve is steeper and the frequencies are also higher. Hence a slight error in adjustment will have a greater effect on the reading. The accuracy is about 2 per cent. for wave-length measurements, but this is not true for other measurements. At the upper part of the scale greater accuracy may be expected. This will be treated more in detail later.

TUBE

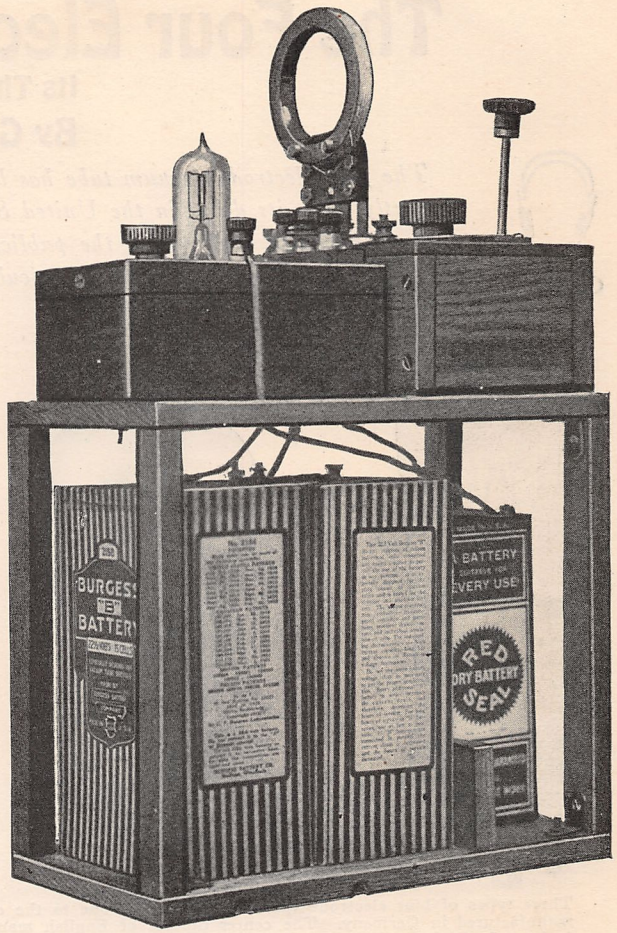
The tube is a WD-11 or WD-12. It is necessary to burn the filament always at its full brilliancy, not only to pass as much plate current as possible, but also to maintain the frequency of the oscillations emitted by the wavemeter constant. With care, the proper brilliancy may be judged by eye. The plate battery used by the writer has a potential of 45 volts. This was found necessary in order to make the wavemeter function properly on the very short wave-lengths. Fig. 1 shows a .002 mfd. condenser shunting the "B" battery.

This condenser should be of a type made up of tin or copper foil and mica sheets as the dielectric. With a good condenser there is little possibility of a short developing.

This completes the description of the apparatus. Reference to the photographs show how the instruments described are assembled; everything is securely fastened.



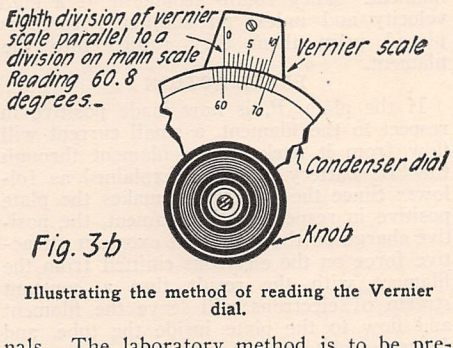
A vernier scale as shown here will give readings of .1 degree. The reading here is 61.4 degrees.



A side view of the Heterodyne wavemeter showing the position of the batteries and the instruments. Note that the Venier knob on the variable condenser is extended to avoid body capacity effects.

CALIBRATION

There are two ways of calibrating the wavemeter. We may calibrate from a laboratory wavemeter or else from standard signals. The laboratory method is to be preferred if an accurate standard is available, but this is seldom the case and we, therefore, must turn to the standard signals. These signals are sent out by WWV at Washington and run all the way from 2000 down to 150 meters. To calibrate the wavemeter the reader must have a short wave receiver capable of receiving over the correct band of wave-lengths and sensitive enough to get WWV fairly strong. It is sometimes difficult to find the station in the short time given, if the signals do not come in well.



Illustrating the method of reading the Vernier dial.

To calibrate the wavemeter proceed as follows:

Allow both the receiver and wavemeter to oscillate and adjust the receiver until WWV is heard. Then adjust until the zero beat position is reached. The receiver is now in resonance with WWV's transmitter. Adjust the oscillating wavemeter until it is oscillating at the same frequency as the receiver (zero beat method again), but do not change the adjustment of the latter. We now have three sets of oscillations all of the same frequency—WWV's signals, the oscillations from the receiver and the oscillations from the wavemeter. When this state of adjustment has been reached, no sound of beat notes or WWV's signals should be heard in the phones. If anything of this nature is heard, the adjustments have been incorrectly made and will have to be repeated. Assuming the correct adjustment, make a note of the condenser reading both main scale and vernier. Take several sets of readings in this way, going through the whole procedure each time. About five readings will be sufficient. After this has been done we may also calibrate the wavemeter at one half of WWV's wave by making use of the harmonics of the receiver. This may be done by leaving the receiver in its original adjustment and reducing the capacity of the wavemeter condenser. A place will be reached where a beat note is heard in the phones (the dial reading will be about one-fourth of its original reading). Tune around this point until the zero beat position is again reached. The wavemeter is now in resonance with the second harmonic of the receiver and consequently is oscillating at one-half the wave-length of the latter. Since, however, the receiver has all the while been in resonance with WWV's signals, the wavemeter is adjusted to one-half of WWV's wave also. We may also calibrate the wavemeter at one-third of WWV's wave by reducing the wavemeter condenser capacity still further and going through the same procedure as above. However, it is not absolutely necessary to make the harmonic measurements while WWV is sending. All we need is the calibration on his main wave. The rest can come later, after the other standard waves have been received. There are usually eight standard waves sent out on one particular evening. After these have been received (at least five readings should be taken on each wave) we can proceed with the one-half and one-third wave calibrations. Set the wavemeter at one of the points obtained originally from WWV's signals. Then adjust the receiver to the zero beat position for that

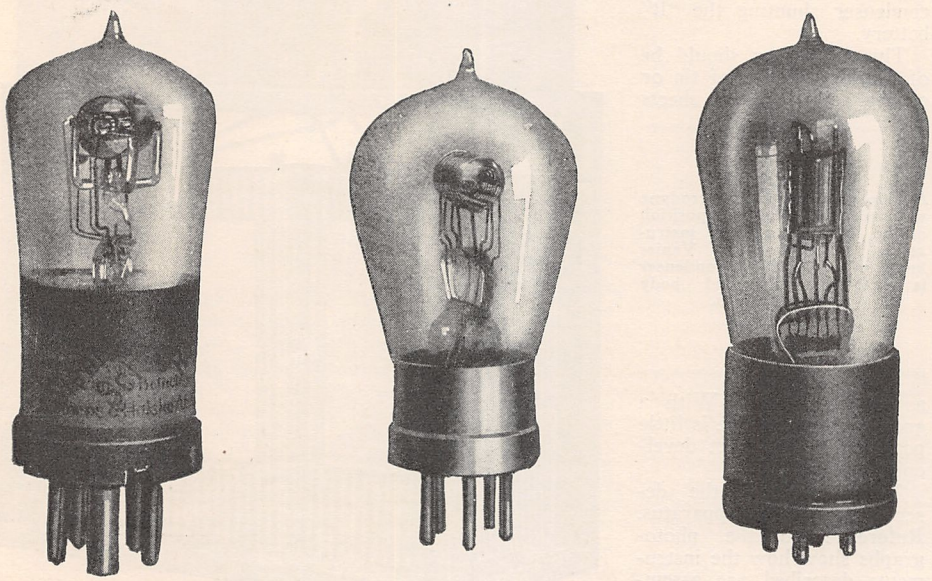
(*Continued on page* 794)

The Four Electrode Vacuum Tube

Its Theory and Operation

By GEORGE IMLACH

The four electrode vacuum tube has been used in European countries for some time. It recently made its debut in the United States in connection with the Solodyne circuit and will, no doubt, find favor with the public. This type of tube can be put to any number of uses. It is particularly adapted to reflex circuits.



Three types of four electrode vacuum tubes. The one to the extreme left is a Schotky tube, manufactured in Germany. The center tube is of English manufacture. Note that the plate is formed of wire, tightly coiled. The tube to the right is of American manufacture and has the popular low current consumption filament.

CONSIDERABLE interest has been aroused lately among the radio fraternity by the advent of the four electrode tube. Although such tubes have been manufactured and placed on the market in England for some time, very little is known regarding them on this side of the Atlantic except among the more advanced radio technicians. It is, therefore, the writer's purpose to give a description of their theory and operation and to give a few circuits to be used with them.

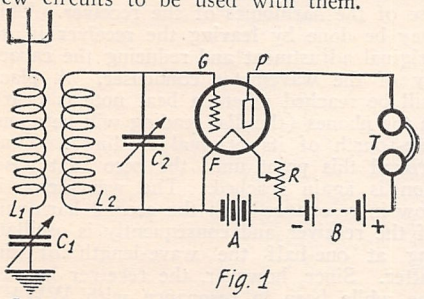


Fig. 1

Common form of non-regenerative circuit employing a three element vacuum tube.

Most of the readers of this article will probably be familiar with the theory of operation of the common three electrode tube; however, some may not be well versed in its operation and as a knowledge of the three electrode tube operation is necessary to understand the principles of the four electrode type, I propose giving a brief description of the operation of the former before passing on to the more advanced matter.

Let us consider the diagram in Fig. 1. This shows a circuit of the non-regenerative type. The filament, F, of the tube is brought to a certain temperature by the battery, A, the amount of current flowing through the filament, and therefore its temperature, being controlled by the rheostat, R. When the filament is brought to a certain temperature negative particles, called electrons, are emitted from the filament, which fill the space in the vicinity of the filament. They rotate around it at a high velocity and unless an additional force is placed upon them they return into the filament.

PLATE ACTION

If the plate, P, is now made positive in respect to the filament, a small current will flow from it back to the filament through the "B" battery. This is explained as follows: Since the battery, B, makes the plate positive in respect to the filament, the positive charge on the plate will exert an attractive force on the electrons emitted from the filament with the result that a constant stream of electrons will leave the filament and flow to the plate inside the tube, and from the plate back to the filament through the external plate circuit, through the phones and battery, B, to the filament. Thus a constant current will be maintained in the plate circuit as long as the plate is positive in respect to the filament.

As will be seen from Fig. 1, the tuned radio frequency circuit, L2-C2, is connected between the grid and the filament of the tube.

When the positive half of the cycle of radio frequency current is placed in this circuit a small current will flow in it due to the attraction exerted by the positive charge on the grid upon the electrons. This positive charge, however, is prevented from rising to its full value by the flow of grid current, which has a damping effect on the positive half of the cycle. This positive charge on the grid acts as an extra attractive force on the electrons which is added to the plate attraction, thus increasing the plate current—to no great extent however.

When the negative half of the cycle is placed on the grid, it becomes charged negatively to the full value of the half-cycle. This is because no current flows in the grid circuit because the negative charge on the grid repells the electrons. The effect of a cycle of radio frequency current is, of course, to alternately increase and decrease the plate current.

Each cycle of radio frequency current has the same effect on the plate current, the result being a series of increases and decreases, with the *decreases* of higher value than the *increases*. These increases and decreases result in an average decrease which causes a click in the phones.

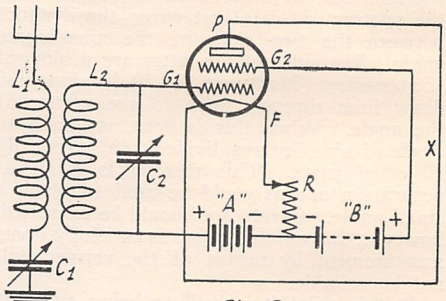


Fig. 2

The same circuit as Fig. 1, but employing a four element vacuum tube.

ELECTRON SPEED

The speed of the electrons varies as they move from the filament to the plate. Let us take the case of a single electron. When it leaves the filament it is attracted by the positive charge on the plate and begins to

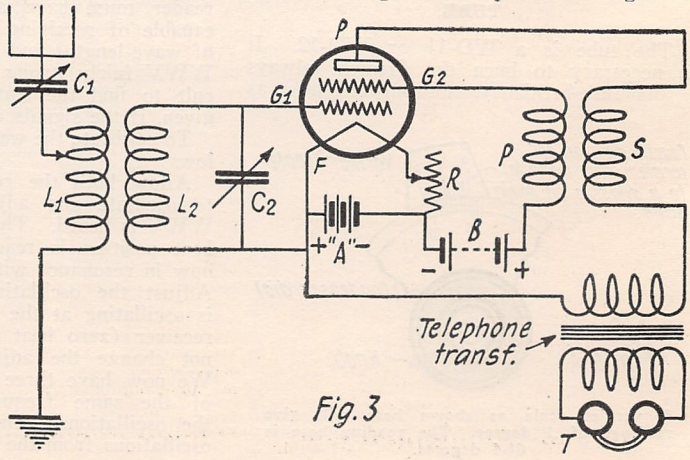


Fig. 3

This embodies the circuit of Fig. 2, except that a radio frequency transformer has been included in the plate circuit of the four element tube and a telephone transformer and head-phones inserted for audible reception. In this arrangement the tube is playing a dual role, acting as both a radio frequency amplifier and detector, and performs thus in a very efficient manner.

move towards it. There is, however, a slight repelling action caused by the crowd of electrons gone before it which constitute a negative force between the plate and the filament called the "space charge." When the electron has gone half way to the plate its velocity has increased considerably due to the reduction of the distance between it

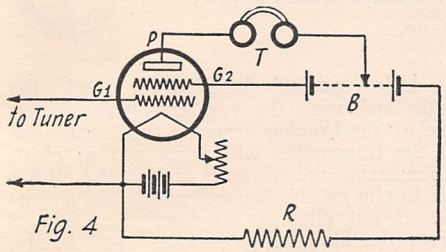


Fig. 4

Circuit diagram of a four element tube employed as an audio frequency amplifier, with resistance coupling.

and the positive charge and to the elimination of the repelling action of the space charge. In this position the electron has half of the space charge ahead and the other half behind it so that the repelling action ahead is neutralized by the repelling action behind it. As the electron nears the plate its velocity is constantly increased.

Thus we see that the velocity of the electrons in a vacuum tube is very much higher when they reach the plate than when they leave the filament. This must be well understood if the reader is to understand the operation of the four electrode tube, to which we shall now pass on.

FOUR ELEMENT TUBE

Suppose in Fig. 1 we substitute a spiral of wire (similar in construction to the grid) for the plate, P. The tube will then operate in exactly the same manner as before. This we have done in Fig. 2, where we have changed the construction of the plate to the form of a spiral of wire and also we have added an additional electrode in the form of a plate, but which actually does the work of a grid, as will be shown later.

In this diagram the plate is connected to the negative end of the filament and, therefore, it will be at the same potential as the negative end of the filament. As a result the velocity of the electrons will increase (as previously explained) as they move from the filament to the second grid, G2. Some of the electrons, however, will pass through G2 owing to their very high velocity and move towards the plate, P. At the plate their velocity will be approximately the same as when they were emitted from the filament.

Now suppose we apply a small alternating potential at the point X. The plate, P, will be alternately positive and negative in respect to the negative end of the filament.

When the positive half of the cycle is on the plate there will be an attraction of electrons and a small current will flow in the plate circuit. When the negative half-cycle comes in, however, it will exert a repelling action on the electrons and no current will flow. The same is the result for each cycle. Thus the current in the plate circuit will be a series of current impulses due to the positive halves of the cycles. In other words, a rectified current will flow in the plate circuit.

A slightly different arrangement wherein the plate of the four element tube does the work of the second grid and the second grid functions as the plate. A crystal detector is employed as a rectifier thus avoiding current complications that would otherwise tend to produce distortion.

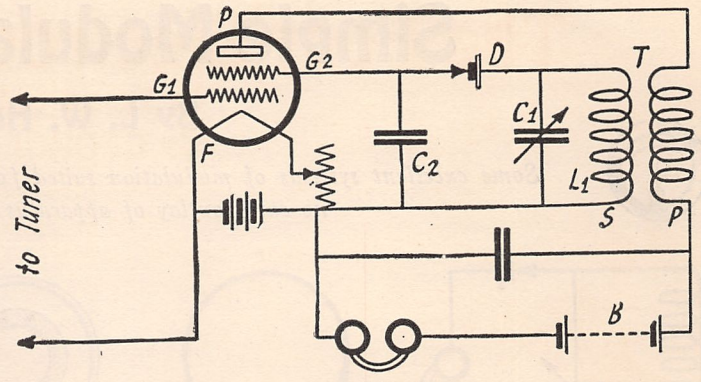


Fig. 7

RADIO AMPLIFIER AND DETECTOR

The principles of Fig. 2 are embodied in the circuit shown in Fig. 3, which is similar to Fig. 2 except at the point X the secondary of a radio-frequency transformer and a pair of telephones are inserted. The primary of the radio-frequency transformer is connected in the second grid circuit. The filament and two grids constitute an ordinary three electrode tube working as a radio frequency amplifier, the amplified radio frequency current being transferred to the plate circuit through the transformer. This circuit works as a radio frequency amplifier and detector. Thus we see that the four electrode tube is doing the work usually done by two tubes of the three electrode type.

In Fig. 4 is shown another circuit using resistance coupling. The variations in the current in the second grid circuit causes variations in the potential across the high resistance, R. These potential variations combine with the potential of that part of the "B" battery in the plate circuit, causing audio frequency currents to flow in the plate circuit.

Fig. 5 shows a circuit utilizing the four electrode tube as a radio frequency amplifier, detector, and an audio frequency amplifier. The radio frequency variations in the current of the second grid circuit are applied to the plate through the radio frequency transformer, T. The rectified current in the plate circuit is fed back to the first grid of the tube in a similar manner as used in the familiar reflex hook-ups. The coupling at K may be a resistance, as shown, a choke coil, or an audio frequency transformer. In each case it is necessary to put a fixed condenser across them so as to facilitate the passage of the incoming radio frequency oscillations.

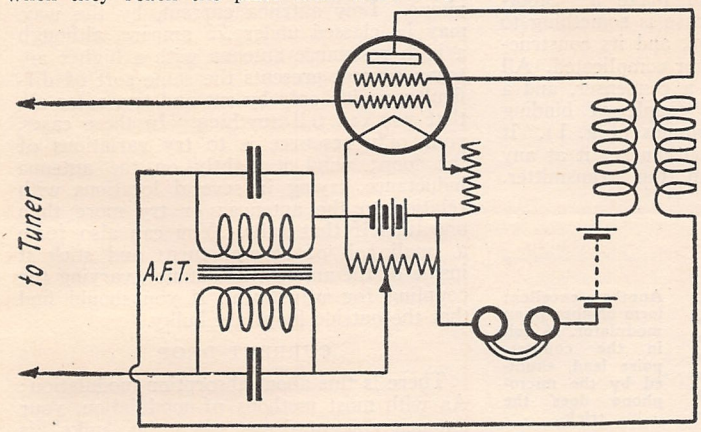


Fig. 6

This is similar to the electrical arrangement of Fig. 5 except that an audio frequency transformer replaces the resistance K in the former. A potentiometer is included so that the necessary losses may be introduced to prevent the tube from oscillating. As in most forms of reflex circuits, by-pass condensers are required across the primary and secondary coils of the audio frequency transformer.

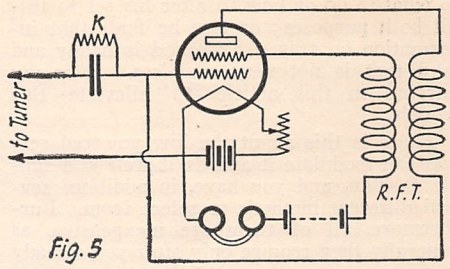


Fig. 5

Employing this circuit, the four element tube functions as a radio and audio frequency amplifier and detector.

Fig. 6 shows a circuit similar to Fig. 5, but using transformer coupling at K. A stabilizer is also used to stabilize the tube, that is, to prevent the tube from oscillating.

WITH CRYSTAL DETECTOR

In Fig. 7 something slightly different is shown. Here the plate does the function of the second grid and the second grid does the function of the plate, and a crystal is used as a detector. As will be seen from the diagram, the filament, first grid and plate

(*Continued on page* 740)

The circuit diagrams of the four electrode vacuum tube receiver employed by the British Marconi Company for use on ships. The single tube functions as a radio and audio frequency amplifier and detector. The radio frequency stage is tuned by means of taps on both primary and secondary coils. A telephone transformer and low resistance phones are employed though this arrangement is not essential. A potentiometer affords the means of stabilizing the circuit.

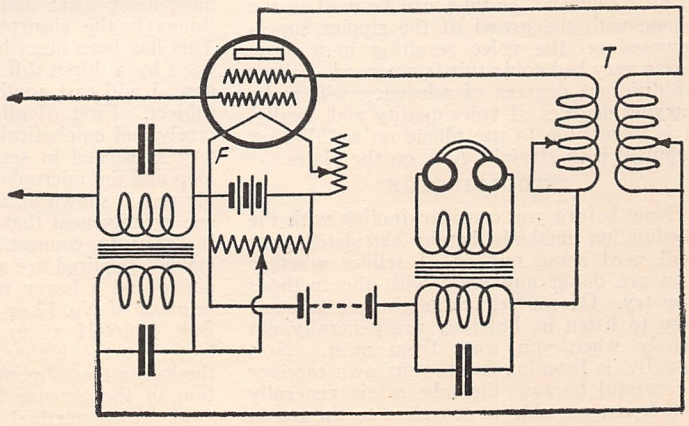


Fig. 8

Simple Modulation Methods

By L. W. HATRY, 5XU

Some excellent systems of modulation suited for low power C.W. transmitters which require no extra outlay of apparatus aside from the microphone.

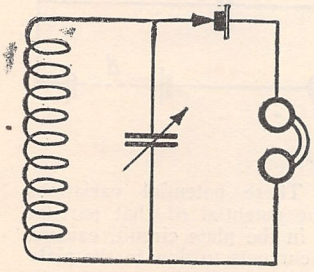


Fig. 1

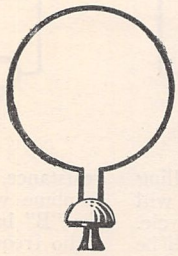


Fig. 2

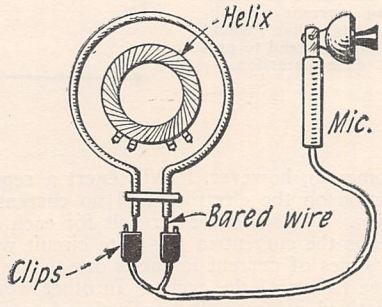


Fig. 3

Fig. 1. Circuit diagram of the "Stoolpidgeon" employed for checking up on modulation. Fig. 2. Loop or absorption form of modulating system. Fig. 3. Suggested attachment and placement of loop modulator.

THE Ham with the one or two tube set of low power (speaking of transmitters), who desires to be able to use phone as well as C.W. so that he can have the fun of talking a bit, finds himself in something of a quandary as to what to do or how to alter his set to fulfill both purposes; or else he finds that information on only one method is handy and even that is not very complete. It is my purpose in this article to alleviate this trouble.

There is this about the low powered set: you can modulate it and do it well in a simple fashion, and you have, in addition, several different methods to select from. Furthermore, all of them are inexpensive, as generally they require only stuff you already have; of course, the microphone is an extra necessity. This article, then, is addressed to the problematical Ham mentioned above and, in addition, to his brothers, the experimenter, who could not be satisfied with one method, and the fellow who has never tried phone. This last mentioned Ham has missed quite a thrill, the thrill of tossing his own voice across the continent—providing, of course, his set reaches out—or in eliminating the drudgery at the key for local work and chewing the rag just as if he were at his club or on the corner.

Of course, before you even consider fooling with phone, it is necessary to have a plate supply that is at least within hailing distance of D.C., the nearer, the better. Straight D.C. gives you a voice, on the air, normal and natural. Rectified A.C. as delivered straight from the rectifier, whether "sink," chemical, or tube, can be used in the phone with the growl of the ripples superimposed on the voice resulting in a noise like a very bad cold; this is not good. Filters of different degrees of adequacy will make varying degrees of voice quality and, finally, it is impossible to use phone on a C.W. set supplied with straight A.C. on the plates.

"STOOLPIDGEON"

Now before you consider fooling with the modulation methods herein elucidated, you will need some method of telling whether you are doing any good with the methods you try. Of course, you might get someone else to listen in, but they are generally not handy when you want them most. Nor, usually, is listening in on your own receiver successful because the tube set is generally either not portable or too close to the transmitter and thereby too full of energy to give an honest and straightforward report of what is occurring when you yell into the "mike." So you should make a "Stoolpidgeon," which in this case is something to tattle on your modulation, and its construction is neither laborious nor complicated. All that is needed is a coil, a condenser, and a crystal detector with a couple of binding posts for attaching the phones (Fig. 1). It should be portable so you can set it at any necessary distance from the transmitter.

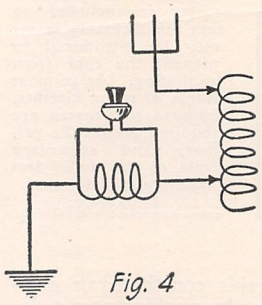


Fig. 4

Another excellent form of absorption modulator. A coil in the counterpoise lead, shunted by the microphone does the trick.

Also, it can be made with a variometer as the tuning element, or with a tapped coil instead of the coil and condenser. A 30-turn coil of scrap wire on a handy form with any size condenser between 11 and umpty-ump plates, if it is variable, is O.K. No matter how you build this Stoolpidgeon, be sure that you do, for it is almost indispensible in modulation experiments.

The method of modulation you hear most of nowadays among those who traffic in the most inexpensive and simple ways of doing things is the absorption or "loop" method. This has been described in a dozen different ways by a dozen different Hams and, I suppose, I will cast another kind of light on the subject. First of all, let me say, both sincerely and emphatically, that no sort of battery is needed in series with the absorbing loop and the microphone. The circuit is simple and is shown accurately in Fig. 2, and is one arrangement that it honestly can be said is "easy to connect." The two important articles required are a high resistance microphone and a heavy wire loop; the loop can be made of No. 12 or 14 rubber covered wire. Suit yourself as to how you mount your loop, but the higher your antenna current, the looser the coupling it will require in relation to the antenna inductance.

My own method of attaching the absorption loop is to adjust it with about 1 inch spacing between it and the helix and with the two ends fastened on one of the bracing arms of the framework of the transmitter with some sort of cleat. Then baring the two ends of the wire allows me to clip on the "mike," which has a couple of test clips on its terminals. Fig. 3 gives the idea. This is cheap and handy, and represents minimum losses when the phone is not used. As the coupling of the loop is important for best modulation, I have only to bend the loop up or down to vary its relation between aerial and ground.

A jack and plug system of connection is not used because a jack is equivalent to a small condenser and a poor one, resulting, with the loop, in a closed R.F. circuit that does a little absorbing of its own when not in use. I feel that I have too many losses if I have any so I won't chance any more.

Sometimes this single loop as described won't work because of either low antenna current or a too low resistance microphone. Low antenna current, by the way, may be classed under .75 ampere, although a high resistance antenna with a higher antenna current presents the same sort of difficulty, so it's only by cut and try, after all, that you can tell anything. In these cases, your only resource is to try variations of the loop; wind it tightly on the antenna inductance, trying in several locations with relation to the antenna; or try more than one turn if that fails. You can also form a small coil of several turns and stick it inside of the antenna inductance, varying the coupling for adjustment, if you should find that the outside loops are bulky.

CURRENT DROP

There is this about absorption modulation: As with most methods of modulation, your antenna current drops when the "mike" is connected to the loop. Don't worry if it does because this is a healthy manifestation and one you will come to recognize as a sign that everything is O.K., eventually; for instance, 2.5 amperes on C.W. and 2 amperes when the "mike" is idle and connected for phone. Another thing, your loop is not adjusted correctly unless your antenna current *rises* to a varying degree when the "mike" is used, unless it modulates up. Of course, with a slow moving antenna meter this is difficult or impossible to note, but with the average quick moving thermocouple meter you will see it easily. You can adjust your loop modulation for this if you will use care and patience and remember that the set is *not* adjusted correctly for phone until the antenna current does modulate up. Your microphone will heat somewhat but should not be allowed to get much above lukewarm, for if it does it will "pack" and cause your voice to fade. If your "mike"

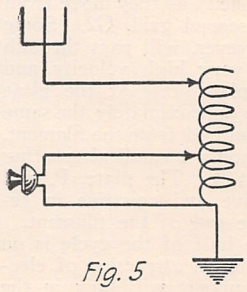


Fig. 5

Shorting a certain number of turns of the antenna inductance with the microphone is, in effect the same as the absorption modulator shown in Fig. 4.

heats, cut down your power until you can work without its heating. When the "mike" packs, the antenna current will act very erratically; jumping up and down with very little relation to your voice.

The quality of modulation from an absorption loop and microphone is amazing and will generally be pronounced perfect if you have a carrier wave decently near D.C. It gets a high percentage of modulation also, when adjusted correctly, and thus allows you good DX representing from ⅔ to ¾ of your regular working range. As an instance, my own results with this method and a couple of five-watt tubes was a consistent 900 to 1,000 mile range with no difficulty at 500 miles at all, barring QRN and QRM. Almost always I raised Hams with C.W. and used phone after connecting because calling with phone is productive of QRM. The best worked record with phone for me is 1,500 miles with this low power, so you see what you can hope for and that you are not trying a dud stunt.

ANOTHER METHOD

Another absorption method of modulation that is good and which I first heard of from Sherrod of 5VY-ZG is to put a small coil in series with the counterpoise lead, the coil to be shorted by the microphone (Fig. 4). (The ground shown is not necessary). The coil in series with the counterpoise is composed of several turns of heavy rubber covered wire, the correct number of turns being determined by test and by the manifestation of the same indication as for the method described above; namely, antenna current modulating upward and a cool microphone as well as a favorable report from the "Stoolpidgeon." That the method is both efficient and effective I can testify, having worked 5VY many times, listening with pleasure to his perfect modulation and excellent volume. He adds to my statement that the antenna current should modulate upwards, "Don't let anybody tell you different." At least, please go at the job with that in your mind. 5VY's modulation system will not work in every case or for everybody and should be tried with the coil also in the ground lead before deserting the method as a failure. This modulation coil should be shorted from the circuit when your set is used for C.W.

SHORT INDUCTANCE

A third method of absorption modulation is shorting a certain number of turns of antenna inductance with the microphone, starting with the ground as one terminal (Fig. 5). This system is not very effective with much power, but it possesses the virtue of working with almost any transmitter except one that uses a very few turns between antenna and ground. For best results an antenna helix is required that allows variation to the fraction of a turn as then, and then only, is it possible to get the critical adjustment really needed. This method is successful and good if all these conditions are observed, and produces a good quality of modulation. Also, it modulates your antenna current down instead of up, placing your full reliance on your "Stoolpidgeon" and is your only report of proper adjustment.

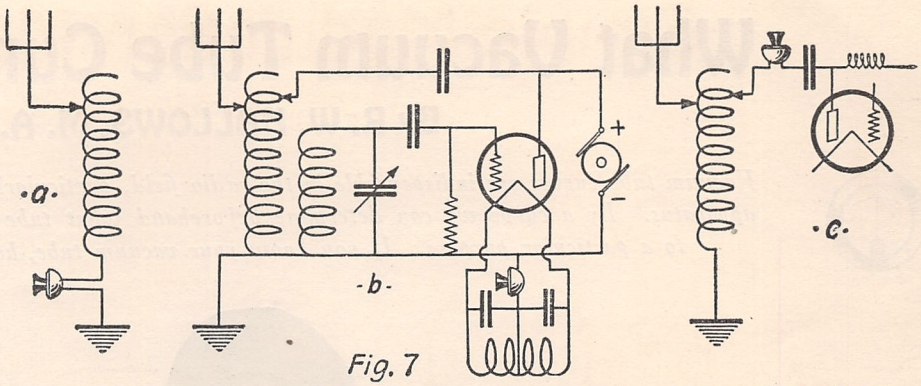
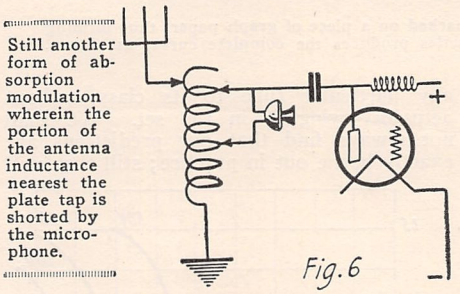


Fig. 7

Three forms of resistance modulation wherein advantage is taken of the varying resistance of the microphone when spoken into.

The last method that I shall describe under the head of absorption is the shorted plate turn. I call it this because your "mike" is used to short a portion of the antenna inductance, starting with the plate tap as a terminal (Fig. 6). It is only possible, also, on a transmitter that uses the shunt-feed connection of the high voltage; also shown in Fig. 6. In adjusting this arrangement you short only one turn by the microphone and increase the number of turns in the plate circuit until speaking into the microphone results in an increase in antenna current, always keeping only one turn in the microphone circuit until this condition is reached. After getting the antenna current to go up with the voice, vary the number of turns included in the "mike" circuit for best results. The big disadvantage of this method, which is effective, is that the "mike" is "hot," having some of the antenna juice running around in it. It will sting the hands somewhat and the lips noticeably if they should come in contact with any metal portion of the "mike." That it is alive precludes the handling of the "mike," if for no other reason, because of the losses incurred, and means that it must be mounted on insulation. This method can also distort badly so you have full need for your "Stoolpidgeon" when adjusting.



Still another form of absorption modulation wherein the portion of the antenna inductance nearest the plate tap is shorted by the microphone.

Fig. 6

RESISTANCE VARIATION

Getting outside of the absorption methods of modulation, we take up what I shall call resistance-variation methods. Of course, the absorption loop's fundamental action is merely resistance variation, too, but because these others are more obviously so, the "mike" being connected in the circuit directly rather than inductively, the differentiation is made. I differentiate for the same reason we give slightly different regenerative circuits different names when they all work on the same principle. So, I admit, in spite of the names, that every modulation method I have or am going to describe depends upon the variation of resistance for its action.

The simplest methods of resistance modulation are the connecting of your microphone in one of these places; the ground lead, in the filament return, or in the plate circuit. (Fig. 7, a, b, and c, respectively.) A works successfully only with very low powers and a low resistance "mike" requiring adjustment of the plate tap for best results and sometimes retuning. B, with the "mike" in the filament return, results in a moderately effective and useful system that will handle good power with good results. Readjustment of the plate tap is necessary for best results. Also, the microphone should have shorted leads, about six inches to a foot long if feasible. Distortion is usually not experienced. Putting the "mike" in the plate circuit, c, is not always effective but will work well when it does. It is possible only on a set that uses the shunt high-voltage feed and even at that is alive with H.F. energy, requiring that it be insulated to avoid losses. All of these methods result in the antenna modulating downward in general practice.

Another simple and good method of modulation is illustrated in Fig. 8, a and b. It is best when used with the Hartley circuit, but may also be used with the reversed feed-back on the grid coil which is illustrated in b. In either case you adjust for modulation with both the variable condenser, which, in the case of the Hartley circuit, should be a .001 mfd. variable and in the case of the reversed feed-backs, whatever variable you use now, and the variable tap running to the plates of the tubes. The adjustment of the variable and the plate tap will both be found to be critical. In general, the resistance of the "mike" is not important and the results are good or excellent. However, the system can distort and the use of the "Stoolpidgeon" is an absolute necessity. The system is worthy of your trial if only to learn about it, and it might turn out best for your set. The antenna current doesn't vary much, if at all, in either of these modes and then usually down.

I want to enter a final plea for the construction of the "Stoolpidgeon." *You need it!* Furthermore, you will be able to use it often to listen in on your voice and a thousand times in experiments. It prevents inflicting horrible modulation on an otherwise peaceful air.

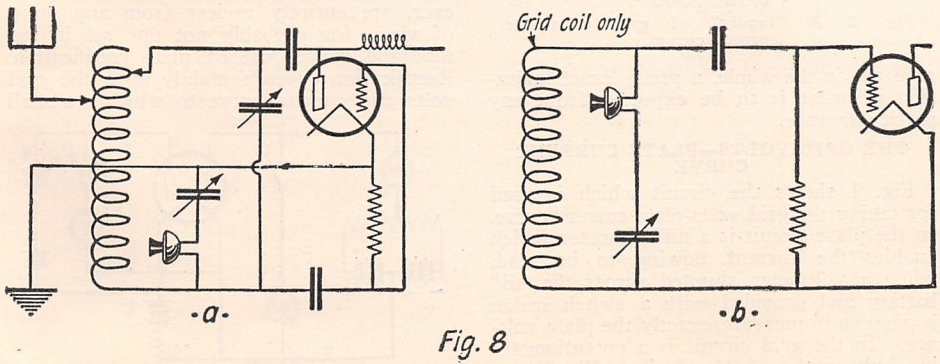


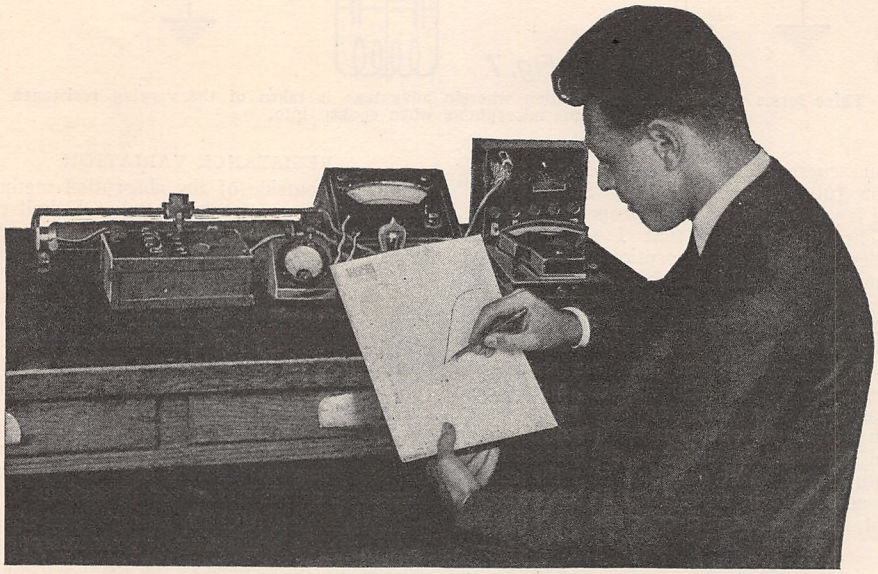
Fig. 8

Resistance modulation adapted to the Hartley circuit (a) and to the reversed feed-back circuit (b).

What Vacuum Tube Curves Mean

By R. W. HALLOWS, M. A.

Vacuum tube curves are indispensable in the radio field, particularly in the design of relative apparatus. By a curve we can determine beforehand what tube or tubes are best adapted to a particular purpose. If you know your vacuum tube, half the battle is won.



The readings taken from the test apparatus are marked on a piece of graph paper, thus forming a series of dots. Running a line through this series produces the complete curve, as shown.

HOW many amateurs, I wonder, can "read" a set of vacuum tube characteristic curves? These things must obviously mean something, but comparatively few people are able to say just what they do tell about the particular tube to which they refer. Most makers issue certain curves for their tubes and others are to be found in the accounts of tests which are published in the technical press. These do actually give us a very great deal of useful information about the performances of a tube, and, if we can read them properly, they help us to use it in the receiving set in such a way as to get the very best out of it. If you place in the hands of an expert the particulars of several motor cars, including the cylinder capacity, the wheel size, the gear ratio and so on, he will have very little difficulty in sorting them out into classes; he will be able to tell you which of them are most likely to be speedy on the race track, which useful as touring cars and which most suitable for taking heavy loads at slow speeds. Now with tubes we are concerned with problems of very similar nature, for we too must be able to classify. The tubes of our sets have three entirely different functions to perform, in radio frequency amplification, rectification and audio frequency amplification. Curves give us just the information we want in order to be able to assign any particular tube to its class without actually trying it in the set. We shall not always find that our predictions are exactly borne out in practice; still they will give us, on the whole, a pretty exact indication of what is to be expected from any particular tube.

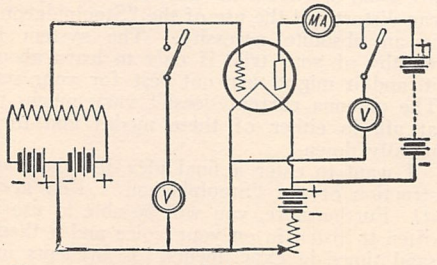


Fig. 1. Circuit used for making the grid volts-plate current curve.

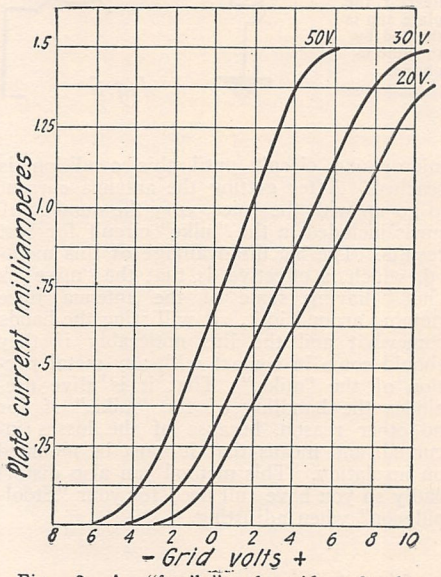


Fig. 2. A "family" of grid volts-plate current curves.

THE GRID VOLTS—PLATE CURRENT CURVE

Fig. 1 shows the circuit which is used for taking the grid volts-plate current curve. In the plate circuit is a milliammeter which enables the current flowing to be read, while a voltmeter shunted across the "B" battery and provided with a switch makes it possible to measure exactly the plate voltage. In the grid circuit is a potentiometer in shunt with a battery of small cells, to the middle point of which is connected a lead from the negative leg of the filament. A second voltmeter placed in this circuit enables the tester to ascertain the grid voltage with respect to the negative leg of the filament. This voltage can be made of any positive or negative value within the capacity of the battery by moving the slider of the potentiometer. In practice the plate voltage is first adjusted to a value of, say, 20 volts. The potentiometer is then moved over to the negative side until the milliammeter in the plate circuit shows a zero reading. The grid voltmeter now shows the grid potential required to dam back entirely the electron emission from the filament. The potentiometer slider is now moved slightly towards the positive side and milliammeter readings are taken at each volt as the grid becomes more and more positive. A dot representing each reading is made on a piece of graph paper.

When further increases in the positive potential upon the grid make little or no difference to the current flowing in the plate circuit the tester knows that he has reached the saturation point; that is to say, the plate is now receiving every possible electron from the filament. He then starts upon a second test, increasing the plate potential to perhaps 30 volts and proceeds as before. Having once more come to the saturation point he makes another curve with a still higher plate voltage. He then draws in freehand curves, following as nearly as possible the sets of dots which he has made upon the paper. The result is a "family" of curves such as that shown in Fig. 2. Now what can we learn from the particular family illustrated in this diagram?

In the first place, with the filament voltage used (we will see presently how this is determined) this tube shows a saturation current of about 1.5 milliamperes. It will not, therefore, be suitable for working a large loud speaker if used as an audio frequency amplifier. Secondly we see that progressive increases in the plate potential move the curve considerably greater distances to the left. Hence, with something rather higher than 50 volts, we shall have a curve well to the left of the zero line, which should give good and undistorted audio frequency amplification. The tube is, therefore, very suitable as a first stage audio frequency amplifier. How will it do as a rectifier? Some would prophesy excellent results on account of its "well marked lower bends." These bends, however, are entirely useless from any point of view, for probably not one set in ten thousand makes use of plate rectification. Rectification depends mainly upon the grid volts-grid current curve to which we shall

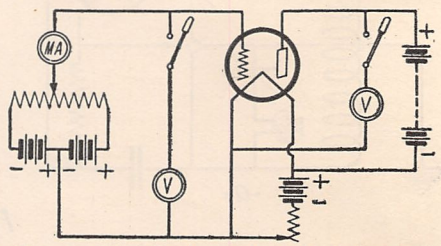


Fig. 3. The circuit employed for obtaining grid current curves of vacuum tubes.

come presently. As has been pointed out, the rectifying tube has two functions to perform: It acts in the first place as a diode or Fleming tube for rectification purposes, and in the second as an audio frequency amplifier. Its working grid potential will usually be in the neighborhood of zero grid volts and the voltage changes upon its grid will not be very large unless several stages of radio frequency amplification are used before it. What we want in the grid volts-plate current curve of the rectifier is a good straight portion on either side of the zero grid volts line. This we have in the 50-volt curve of the tube under discussion.

For radio frequency amplification again we require a well defined straight portion of the curve, but it is difficult to say whether the tube will do well in that position until we know something about its grid current curve. Of the family of curves that we have been discussing we may say that they appear to be those of a good general purpose tube likely to give very satisfactory results in any part of the set. They are as a matter of fact the curves of the Mullard Ora tube of English make.

THE GRID CURRENT CURVE

Fig. 3 shows the way in which the grid current curve is taken. The plate and filament voltages are fixed at suitable values, then the grid potentials are varied and current readings are taken by means of the microammeter, dots being made and curves afterwards drawn as before. Fig. 4 shows a typical curve of a hard tube. With the grid at zero volts the amount of current may be in the neighborhood of .6 microampere. As the voltage on the grid is made more and more negative the current falls very rapidly indeed until at .6 olt negative a zero reading is obtained. From this point onward, a rather curious effect takes place.

Reverse current is found to flow, which in the case of the tube the curve of which is given in Fig. 4 reaches a maximum of .14 microampere at 1.8 volts negative. The gradual increasing of the negative grid potential now has the effect of reducing the backlash current until at 4 volts we again have a zero reading on the microammeter. The reverse current or "backlash kink" is caused in a rather interesting way. No tube contains a really perfect vacuum; there must always be present within the bulb gas molecules. As electrons pass from filament to plate they collide with gas atoms and owing to their speed actually drive electrons out of them. This process is known as ionization by collision. It results in the formation of positive ions which normally return to the filament. When, however, the grid has reached a certain negative value it begins to attract these positive ions, with the result that a reverse current flows. The process goes on until the negative potential of the grid reaches a point at which its electron-stopping and ion-collecting qualities are balanced. When this happens reverse grid current is at its maximum. If we make the grid more and more negative it will dam back the flow of electrons from the filament; hence there will be fewer positive ions and the reverse grid current will fall.

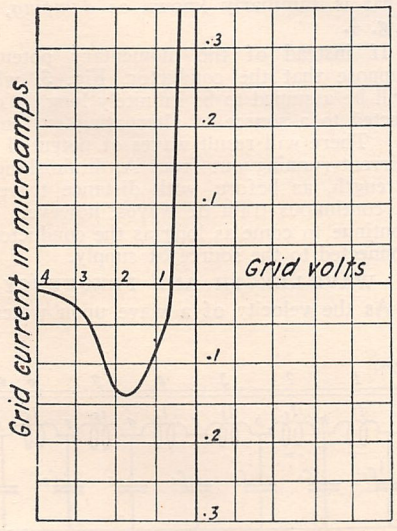


Fig. 4. A grid current curve obtained from a hard tube.

Fig. 5 shows the grid current curve actually obtained from a *soft* Dutch tube. Here the flow of positive grid current at zero grid volts is very much higher than in the last case, reaching a value of over 55 microamperes. This is due to the fact that the larger quantities of residual gas within the tube make for a much greater amount of ionization by collision. The electron stream from the filament is denser, and a greater number of electrons is caught in the meshes of the grid. The positive ions submit the filament to a heavy bombardment. For the same reason the backlash kink is again very much larger, reaching in this case a maximum value of .98 microampere. We now see one thing that the grid volts grid current curve will tell us: it gives us to a great extent the measure of the tube's hardness. Secondly it gives us a very fair indication of how the tube will function as a rectifier. Fig. 6 shows how grid current is used for rectification purposes. For rectifying, therefore, we require a tube with a well marked backlash kink

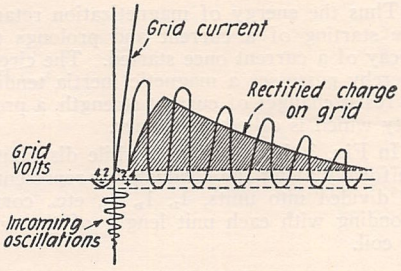


Fig. 6. Illustrating how grid current is used for rectifying purposes.

in the grid current curve. Fig. 6 is further interesting from another point of view, for it shows us how we sometimes obtain a curious kind of distortion by the use of several stages of radio frequency amplification: the voltage changes applied to the grid of the rectifier may be so great that it is overloaded by them, the negative half cycles going far beyond the point of maximum reverse grid current and possibly even reducing the flow to zero once more. It shows us, too, that we must adjust the plate and grid voltages of radio frequency amplifiers so that no rectification is taking place in them, otherwise we may expect distortion from that cause. From the curve of the soft tube we can see why it is that these tubes are so efficient as rectifiers, especially when they are used on single tube sets where the voltage changes upon the grid are very small indeed. For a rectifier, then, we require a respectable flow of positive grid current at zero grid volts, while for the radio frequency amplifier grid current must not be too high at zero grid volts, otherwise pronounced damping and distortion of the wave forms will occur.

The curves given in Figs. 4 and 5 may be read as follows: The tube from which the first was made should be an efficient rectifier and should also do well as a radio frequency tube, for the grid current is quite small at zero grid volts. The second will rectify very well, provided it is used by itself or with no more than one stage of radio frequency amplification in front of it. It

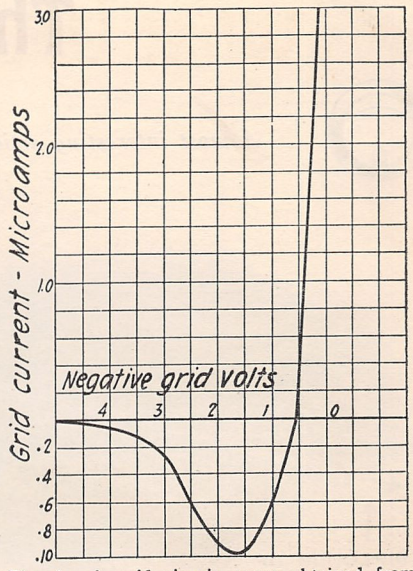


Fig. 5. A grid circuit curve obtained from a soft (detector) tube.

will not function with anything like success owing to the large current at zero grid volts.

Grid current provides us with one of the most interesting instances of the importance of the minute in radio. The curve shown in Fig. 4 appears quite large, but that is merely because it is drawn to a much bigger scale than those in Fig 2 for instance. To draw the latter on the same scale as the grid curve we should have to increase the height of the vertical line ten thousand times. Suppose you draw both the plate and grid current curves upon a full sized billiard table, taking the balk line for the grid volts and making the volt divisions no larger than those shown in any of the drawings in this article. If we draw a line straight through the row of spots down the center of the table we can mark off on this 10 compartments each 10 inches long to represent one milliampere.

Our grid current curve would cross the center line *one hundredth of an inch* above the balk line and its backlash kink would be represented by a curve *dropping one-thousandth of an inch below the line!* To get anything like results we shall have to draw the curves upon a large football field 120 yards in length. Here we can make a center line between the goal posts, dividing it into 10 compartments 432 inches long, each representing one milliampere. The plate current curve would then be a

(*Continued on page* 774)

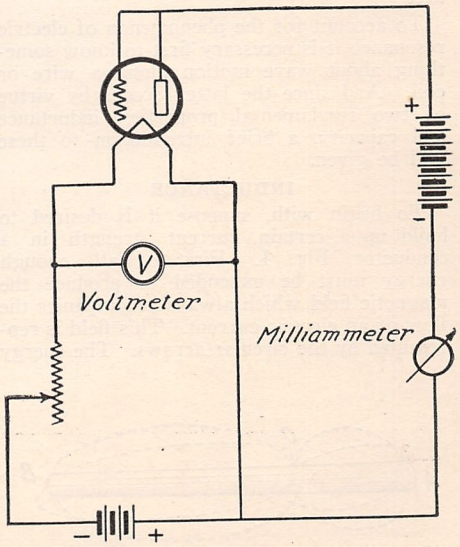


Fig. 7. The circuit employed for making the emission curve.

The Resonant Circuit

By J. M. GRIGG, B.S.

A most interesting article covering a very important subject, that of the effects of resistance, inductance and capacity in resonant circuits.

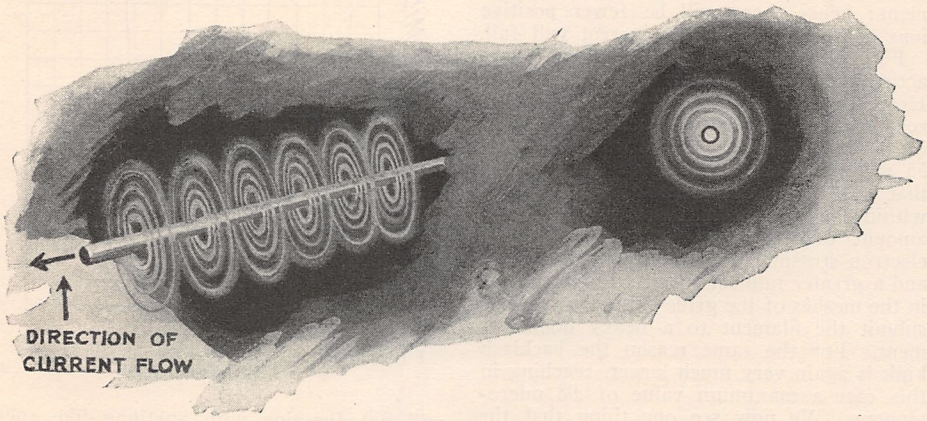


Fig. 1. Any current-carrying wire is enclosed in a magnetic field. This field travels along the wire in spiral fashion to the left or to the right, depending upon the direction of the current flow. The extent or circumference of the spirals is dependent upon the strength of the current.

WHEN we think of radio waves upon an aerial, we think of wave motion with respect to places in the wire. We know that what is happening at one place is not happening throughout the wire at the same time. We consider both time and space, just as we would while observing waves traveling over the surface of water. We consider the space element doubtless because the antenna is relatively long.

On the other hand, we neglect the space element if the wire, instead of being extended, as in the case of an antenna, is coiled into a helix. The voltage and current are then assumed to vary uniformly through the whole with respect to time, the shortness and compactness of coils doubtless leading to the inference that identical changes happen in all places at once.

To deal properly with the phenomenon of electrical resonance we must recognize the fact that on the coil, as well as on the antenna, a linear wave motion is involved. The current or voltage in a tuned circuit, therefore, builds up progressively from wave to wave, and the first pulsations are not amplified to the same extent that succeeding ones are.

To account for the phenomenon of electric resonance it is necessary first to know something about wave motion along a wire or coil. And since the latter occurs by virtue of two fundamental properties, inductance and capacity, a brief introduction to these will be given.

INDUCTANCE

To begin with, suppose it is desired to build up a certain current strength in a conductor, Fig. 1. First of all, enough energy must be expended to produce the magnetic field which always accompanies the flow of an electric current. This field is represented by the circular arrows. The energy it holds is drawn from the current supply, ahead of the current, and when the current decreases, or ceases to flow, it is given back to the circuit.

Thus the energy of magnetization retards the starting of a current and prolongs the decay of a current once started. The circuit thereby possesses a magnetic inertia tending to resist changes of current strength, a property which is called *inductance*.

In Fig. 3 the inductance, while distributed uniformly along the conductor, is represented as divided into units, l_1, l_2, l_3, etc., corresponding with each unit length of the wire or coil.

CAPACITY

Capacity is an electrostatic property of a conductor. Due to it, when a potential exists at some point in the conductor there results an electrostatic field in the surrounding region. The non-conducting region about the conductor is called the *dielectric*. Every point in a conductor may be said to have capacity relative to every other point in it, a property called distributed capacity. In Fig. 2 the curved lines represent the electrostatic field due to a potential at some arbitrarily chosen point 0. This field is due to the capacity or condenser effect between point 0 and the sum of all other points in the conductor.

In Fig. 3 the condensers c_1, c_2, c_3, etc., represent the distributed capacity per unit length. For instance, c_3 is the capacity between unit 3 and the balance of the conductor. In virtue of the many branch circuits, distributed capacity offers by-paths for the flow of current under what are normally known as open-circuit conditions; that is, charging or discharging condenser currents pass.

Capacity may be thought of as a reservoir for the storage of energy, current rushing into it when a potential is applied and discharging into the conductor when the potential disappears.

Assume now that a constant, unidirectional potential is applied at A, Fig. 3. A wave pulse would move outward from A, charging in turn the various condensers, and, with corresponding delays, getting past each inductance. Finally, when all the condensers were charged, current would cease altogether to flow. The outgoing pulsation could be likened to the heavy surge of water which would travel over the surface of a pond when a huge mass was deposited in it, and the condenser charges to the resultant rise of water level in the pond.

Now assume that the potential is applied for only an instant. During that instant the inertia of inductance l_1 opposes the flow of current, but condenser c_1 will get a charge before the potential is cut off. By this time the inertia of inductance l_1 has been reduced, and a path thereby opened for the discharge of the current in the condenser c_1. At A, the inductance l_2 at first opposes the flow of the discharging current so that the first flow is into the condenser c_2. The time of flow will be prolonged somewhat by the conversion of the magnetic energy of l_1 into a current. Before this has been finished, however, the inertia of l_2 has been overcome, and a path is offered for the discharge of C_2. But there will also be a back circuit through l_1 and c_1. C_2, therefore, discharges both through l_2 and l_1, mostly through l_2, however, due to difficulty of reversing the direction of current in l_1. At each capacity and inductance thereafter the same cycle will be repeated with the result that each time a part of the charge is moved ahead. In this manner not a wave pulse but waves following one another in succession will travel along the conductor.

If the conductor were very long, and it were possible to see just what took place, we would observe something analagous to what happens when a pebble is dropped into a pond. There would be a train of waves, apparently starting outward from A and with amplitudes growing less and less as they advanced, until at great enough distance the oscillations would finally be damped out, and each new set starting out from A would be smaller until finally they ceased altogether.

RESISTANCE

To account for this dissipation of energy the property known as *resistance* must be taken into consideration. Due to resistance, in each unit a small portion of energy is expended in heating the conductor. Since this heat is radiated, it is lost, and, consequently, at each unit the transmitted energy would be a trifle less than at the one before. Thus resistance explains why the wave grows smaller with distance. This attenuation is what is familiarly known as *damping*, see Fig. 4.

If instead of the momentary potential, suppose that the conductor, Fig. 3, which will be assumed to be infinitely long, is connected to a source of alternating current at A. There will result waves of potential and current running out from A, diminishing in strength, as before, with distance traveled. A continuous train of waves, however, will continue to come as long as the conductor is connected to the source of supply.

WAVE-LENGTH AND FREQUENCY

As the velocity of a wave upon water is

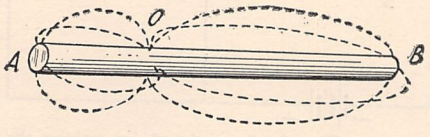


Fig. 2. An electrostatic field surrounding a wire due to a potential at point O.

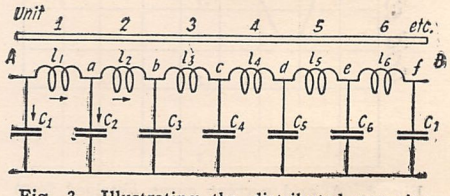


Fig. 3. Illustrating the distributed capacity per unit length in a conductor.

dependent upon certain gravitational and inertial properties, so will the speed of these waves upon the conductor be dependent upon the properties of inductance and capacity. Instead of traveling at the velocity of light, as they would do in free space, their speed will be very much slower. The speed will be inversely proportional to the square root of the inductance and distributed capacity of the conductor —thus, speed $= \frac{1}{\sqrt{ce}}$. The greater the value of these properties, of course, the slower will be the speed, and, as will be shown, the longer the natural wave-length of the conductor or coil. Thus, bring-

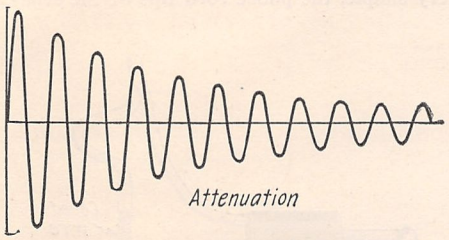


Fig. 4, Illustrating the attenuation or damping of an oscillating current.

ing an antenna nearer to earth increases its capacity, thereby slowing up the velocity of the current (or decreasing the frequency) and increasing the natural wave-length*. The same situation obtains using a spiral instead of a straight antenna for the total inductance is greater. Winding a conductor into a coil, such as is used in a coupler, slows up the speed of the current so much that the wave travels approximately twice the length of the coil only in the time it travels its rated wave-length in meters on the air.

The length of the wave is equal to twice the distance that the wave front would travel during the time the potential was applied; or, in the case of an alternating potential, equal to twice the distance the wave front would travel while the potential went through one complete cycle. Thus the velocity of travel divided by the frequency equals the wave-length.

Now, instead of a very long conductor, suppose that one quite short is chosen. Then when an outgoing wave reaches the end, it can go no farther, and the condenser at the end throws all its charge backward upon the line. Because of this the wave amplitude is momentarily doubled, while at the same time a new wave is started backward toward the source. This process is called reflection. The backward motion of the wave continues until the source is reached, when there will be another reflection, this one due to inductance, and instead of a doubling of the potential the effect is a reversal of the polarity. Presently, therefore, there will be many interfering trains of waves running to and fro, amplitudes, however, growing smaller and smaller due to damping, and finally the earlier reflections dropping out, while new ones take their places.

A similarity of effect has doubtless been observed in the case of water waves, when there are several trains running through and interfering with one another. In this case it will have been noted also that the water rises twice as high where the wave is reflected at an obstructing wall, while the incoming reflections will appear to stand still, half a wave-length from the center, as the phase of this reflection is reversed.

So far as effectiveness is concerned, this random interference of waves might be compared to the case of a crew of workmen on a rope, some pulling one way and some another, and no two pulling together. If they all pulled at once and in the same direction all their efforts would be united in useful work. Likewise, if all these waves and their reflections acted in the same direction and at the same time the resultant effect would be tremendous, and the result would be the phenomena known as *resonance.*

RESONANCE

How all these waves and reflections can be made to act in unison is a problem quite simple of solution. It is a case merely of properly proportioning the length of the conductor to the frequency. Suppose that an alternating potential is impressed at the exact middle, instead of at one end, and that the length of the conductor is such that the wave fronts travel from middle to ends in just a quarter cycle. The round trip of each original and its reflection will be made in just half a cycle. The reversed reflection at the middle will always start upon its next trip in phase with the impressed voltage, and each succeeding wave and reflection will travel in step with the reflections of preceding waves. All the waves on the conductor will, in effect, be piled on top of one another and travel as a single wave, and the voltage on the terminals will build up from wave to wave until the earlier reflections begin dropping out, due to damping, and a balance is reached.

To get a better idea of this building-up process, imagine a pendulum given tiny thrusts each half beat in step with its natural period of oscillation. It is evident that each time the pendulum would sweep through an arc a little wider than before, and finally the point would be reached where it could swing no higher. The energy of the thrusts would be just balanced against the damping of air resistance. This is the actual case of a clock pendulum where the thrust of the escapement is balanced against the damping of friction and air resistance.

Two important conclusions, therefore, have been reached, viz., that the resonant voltage builds up progressively from wave to wave, and that the amplitude at any instant depends upon a relation between the damping

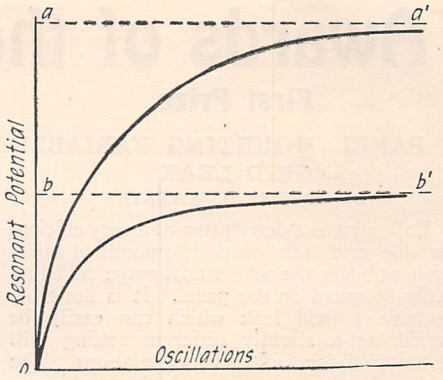


Fig. 5. Two curves illustrating the current growth in a circuit containing resistance and capacity.

losses and the total number of oscillations.

The amplitudes reached by each succeeding oscillation, therefore, increase in accordance with logarithmic law, assuming the succession of impressed wave pulses are of even amplitudes. A curve drawn through the peaks of successive amplitudes is identical in form with the well known curve of current growth in a circuit having resistance and capacity. Two such curves, Fig. 6, illustrate this, the higher curve being drawn for a damping constant one-half that of the other. Ultimate values of resonant potential, as represented by the asymptotes a a^1 and b b^1 are inversely as the numerical value of the damping constant. It is of importance to observe that wave trains of lengths usually met with in broadcasting can at best build up to only a fraction of ultimate values, and that because of this shortness of train, reduction of damping below a certain point profits little.

The foregoing analysis is similar in outline to ones in use many years in explanation of transient phenomena upon wires, cables and antennae, in which connection the pioneer work of such men as Heaviside has

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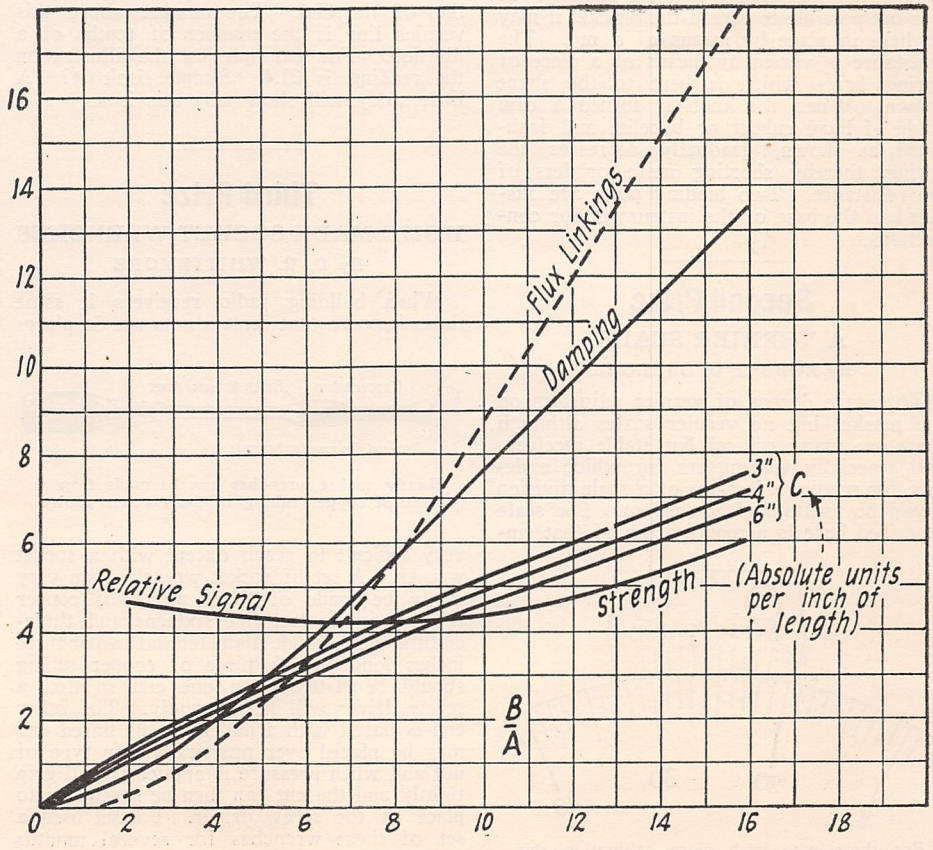


Fig. 11. Curves drawn to illustrate the variation of unit distributed capacity with windings of different diameters.

**Lead is included in total length.*

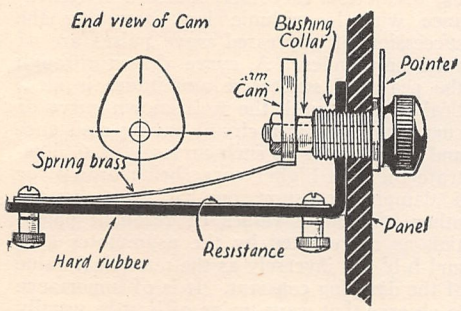
Awards of the $50 Radio Wrinkle Contest

First Prize

A PANEL MOUNTING VARIABLE GRID LEAK

By ROBERT H. WATKINS

Following is a description of a very efficient variable grid leak which is smooth in operation and has the added advantage of being easily mounted on the panel. It is desirable to have a grid leak which can easily be varied, as a slightly different setting will be required for DX and local stations. The grid leak resistance is made by soaking a strip of cloth in India ink and letting it dry. This resistance is then mounted on a piece of insulating material, bent at right angles as shown in the illustration. This is best constructed of a piece of hard rubber about 4½ inches long and 1 inch wide. This piece of hard rubber is easily bent at right angles 1½ inch from one end by immersing it for a couple of minutes in boiling water, to soften it. A bushing, such as that used in an ordinary jack, is obtained. This bushing serves as a bearing and also holds the insulating bracket to the panel. A hole is bored through the short end of the bracket and threaded to take the bushing. If it is not possible to thread the bracket it may be held in place by means of a nut. The resistance is varied by means of a piece of spring brass which is bent to the shape shown. When the knob is turned a cam made of hard rubber or bakelite and fashioned as shown, gradually depresses the spring, thereby shorting more or less of the resistance. Two binding posts are fastened to the base of the instrument for connections.



Constructional details of an excellent variable grid leak employing a cam adjustment.

Second Prize

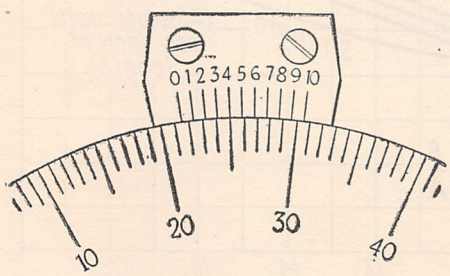
A VERNIER SCALE

By ROBERT G. GARLOCK

There are dozens of vernier adjusters on the market but no vernier scales although there are many critical but stable receivers and especially wavemeters for which a device for reading fractions of a scale division would be useful and convenient. The scale described here is a modification of that employed on calipers and may be applied to any large dial which runs true and is accurately engraved.

Cut a piece of bakelite as shown in the drawing. It should be as thick as the edge of the dial and fit the curve as closely as practicable. The curved edge can be shaped on a small emery wheel, and the straight edges cut with a saw and smoothed with a file. The ten divisions should be engraved with a sharp tool in the same space taken by nine on the dial and filled with white enamel. Accuracy is important in this operation.

The scale is easily read by the following method: Take the dial reading opposite the zero line of the vernier just as if the zero line were the ordinary arrow. Then note which line of the scale is opposite a line of the dial. The number above this vernier line is the number of tenths of a division. For example on the illustration the reading is 21.4. Simple, isn't it? A little study will show why this is so.



For those who wish close calibration this vernier scale is recommended. Put two of these on your Super Heterodyne.

Prize Winners

First Prize $25
A PANEL MOUNTING VARIABLE GRID LEAK
By ROBERT H. WATKINS
North Syracuse, N. Y.

Second Prize $15
A VERNIER SCALE
By ROBERT G. GARLOCK
West Salem, Wisc.

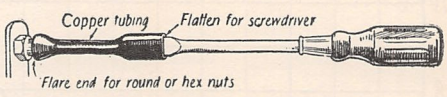
Third Prize $10
HOME MADE SOCKET WRENCHES
By C. R. WHITTEMORE
2635 Eccles Ave., Ogden, Utah.

Third Prize

HOME MADE SOCKET WRENCHES

By C. R. WHITTEMORE

When building radio receivers it some times happens that certain nuts are in places very difficult to reach except with a socket wrench. A set of socket wrenches can very easily be made of three pieces of copper tubing one-quarter, five sixteens and three-eighths inch outside diameter and two or three inches long. Each piece of copper tubing should be flattened on one end so that a screw driver will fit in snugly. The other end is flared with a punch. This flared end may be placed over practically any type of nut and when pressure is applied it will grip tightly and the nut can then be screwed into place by the screw driver. I have used a set of these wrenches for several months in assembling sets and am sure that anyone trying this idea will find it excellent.

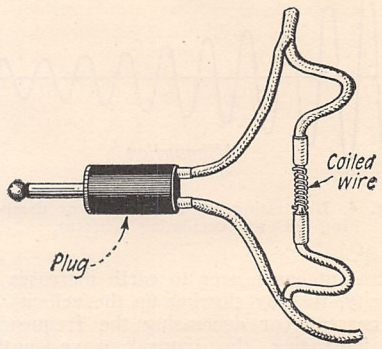


Handy socket wrenches can be made from a piece of copper tubing in the manner shown.

A SIMPLE PHONE CONNECTOR

Here is a little stunt which will prove very handy when two or more pairs of phones are to be connected in series and no connecting units for this purpose are handy. All that is required is a short piece of No. 20 or 18 bare copper wire. This piece of wire is tightly wound around one of the cord tips or any rod of the same size to a length of about one inch. If more than two pairs of phones are to be connected in series two or more of the simple connectors will be required. The method of using is very simple, the phone cord tips of the separate pairs of phones being inserted in each end of the connectors. The accompanying diagram shows very plainly how this little device is employed. It will be found that a good tight connection is obtained which will hold indefinitely.

Contributed by Charles L. Mitchell.

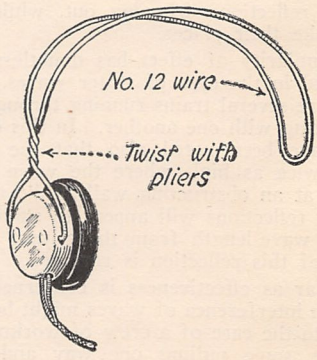


An emergency phone tip connector can be made from a piece of wire, coiled tightly.

SINGLE RECEIVER HEAD BAND

All of us, at one time or another, have had friends come in to listen in with us and if we were not lucky enough to own a two-stage amplifier with loud speaker, the phones, of course had to be used. As a rule there were not enough pair of head sets to go around and we had to "split" them. After a while it proved very tiresome to hold a single receiver to the ear so I devised a head band which could be made in a few seconds and which admirably accomplishes the purpose. The illustration of this head band is practically self-explanatory and very little need be said concerning its construction. About 2½ feet of No. 10 or 12 iron or stiff copper wire is required and is bent into the shape shown, by means of pliers. Two or three of these head bands may be made and used on occasions when there are more listeners present than head sets.

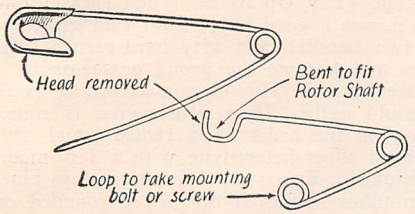
Contributed by Graham Joyner.



When an extra head-band is needed. it can be made in a few minutes with heavy wire.

A SIMPLE VARIOMETER CONTACT BRUSH

Unless a pig-tail connection is employed for the rotor of a variocoupler or variometer, the contact is, as a rule, very poor when the circuit is made through the shaft. A good contact will be had by employing a contact brush constructed of a safety pin. The head of the pin is removed and this end of the pin bent into a semi-circular shape as



A variometer contact brush made from a safety pin. This affords a good wiping contact.

shown in the diagram. The pointed end is bent in the form of a loop to take a mounting bolt or screw. This contact brush is screwed on one end of the variometer in such a fashion that the semicircular end comes in contact with the shaft and makes continuous pressure. With this brush in service there will be little trouble due to imperfect contact when the rotor is revolved.

Contributed by James D. Johnston.

A NAVY TYPE KEY KNOB

A common key knob can be made into a navy type knob by using an ordinary poker chip. The poker chip is drilled in the center so that the screw on the key knob will pass through readily. It is then inserted between the regular knob and the frame of the key and the knob screwed down tightly. Care should be taken when drilling the poker

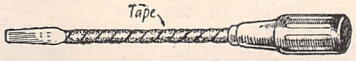
A poker chip transforms an ordinary key knob to one of the Navy type.

chip as it is liable to crumble or break. The drill should, therefore, be turned very slowly in the process to make a neat hole. Besides giving the key an excellent appearance, this simple device is a great improvement over the regular key knob as it will be found that sending is easier with it.

Contributed by H. H. Schoolfield, Jr.

A SAFETY HINT

It has happened to me and no doubt to many others, that while tightening some screws inside of the set, the screw driver has slipped and shorted the "A" or the "B" battery. It also usually happens that the "B" battery will be shorted directly across the "A" battery thereby burning out one or more tubes. This could be prevented by disconnecting the "B" battery, but as a rule, the experimenter does not take the trouble or time to use this safety expedient. This being the case, it is the best policy to insulate the screw driver so that such an



By wrapping a layer of tape around the screw driver, the danger of short circuits is eliminated.

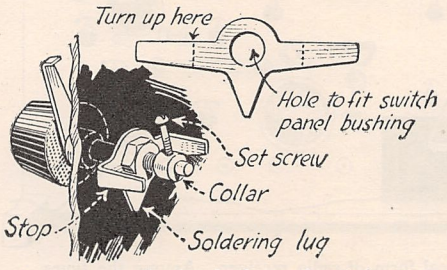
occurrence will be impossible. This is done by wrapping a layer of ordinary friction tape around the metal part of the screw driver down to about one-half inch of the point. This operation is quickly done and it will allow work to be done on the interior of the receiver without fear of shorting batteries or burning out tubes.

Contributed by Nathan Swerdlow.

A BACK PANEL SWITCH STOP

A back panel switch stop which I have used with great success on several sets can very easily be made from a small piece of sheet brass or copper cut as shown herewith.

The bottom projection is left for a soldering lug, while the other two, bent up at right angles on the dotted lines, serve as stop for the set screw on the switch. No dimensions are given as they will be determined by the kind and size of switch it is used for. With the shape shown, the switch will be allowed to cover almost half a circle. For more or less switch points the shape will have to be slightly different.



A neat and effective back panel switch stop.

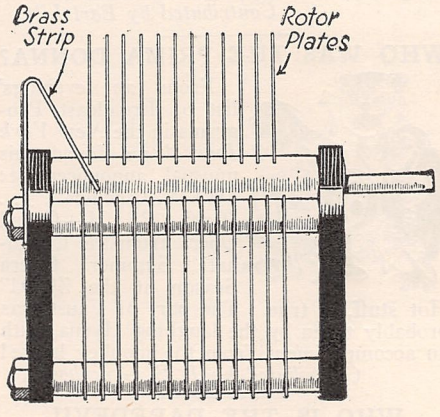
It is best to leave the piece of brass (or copper) flat until it is put on the panel as the nut holding it and the panel bushing can be put on much easier. The projections can then be bent as shown.

Contributed by J. L. McGuire.

A CONDENSER CUT-OUT

In many cases, particularly that of the antenna series condenser, it is often desirable to cut a condenser out of the circuit. The arrangement described below is ideal for this purpose, as it makes unnecessary the use of an extra switch, or a change in the lead-in wiring.

As shown in the drawing, it consists of a brass strip, pointed at one end, and fastened under the nut belonging to one of the



The condenser is shorted when the rotary plates come in contact with the brass strip.

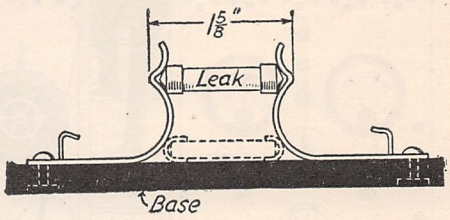
rods which hold the stationary plates together. It may be placed on either the front or back end of the condenser, but must be on the left side. It should be carefully shaped so that it will make contact with the outside rotary plate when the dial is turned slightly below zero.

A condenser with this attachment should not be placed in any circuit where, when it is shorted, the "A" or "B" batteries will also be shorted.

Contributed by Homer E. Hogue.

AN EASILY MADE GRID LEAK MOUNTING

During the course of construction of a new set, the builder often finds that a separate grid leak mounting is necessary. Such a mounting must be employed when the grid leak is connected from the grid directly to the filament. A very easily constructed mounting may be made from two old connection clips. These clips should be bent to the form shown in the diagram and should be mounted just far enough apart that a grid leak of the regular cartridge form will



Spring connection clips are employed to make this grid leak and condenser holder.

be held snugly. An old piece of bakelite or hard rubber of the proper length and an inch wide may be used for the base. Holes should be bored through the base to correspond with the holes in the clips and the clips fastened down by means of screws or bolts. The two small lugs under which the wires are usually held are bent up and the connections are soldered to them. If a condenser of the correct size is used it may also be held by this mounting in parallel with the grid leak by inserting it in the position shown in the diagram by the dotted lines.

Contributed by D. M. Clayton.

A SIMPLE AERIAL SUPPORT

The problem of erecting an aerial on the common slant roof is discouraging, to say the least, and is often one of the most bothersome factors in radio installation.

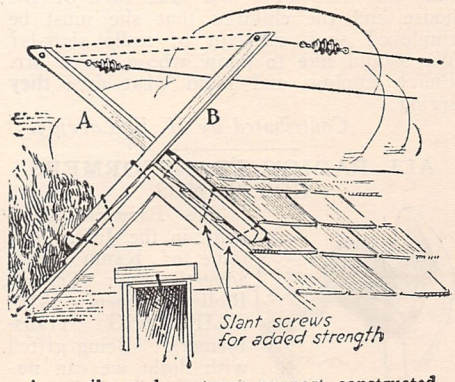
It takes time and often becomes an expensive item to erect a single pole mast on the ridgepole or at the peak of such a house. A special socket arrangement must be provided for the base of the pole and an elaborate system of guying must often be worked out. This necessitates an added expense in insulators and guy wire.

A simple and quickly worked out method of supporting an aerial is illustrated in the accompanying drawing. Any available stock may be used: wooden poles, two by fours, or even iron pipes.

Screw the piece shown as A, flat to the roof allowing three or four feet, as a minimum, to project upward above the saddle board. This will extend the slant of the roof beyond the peak.

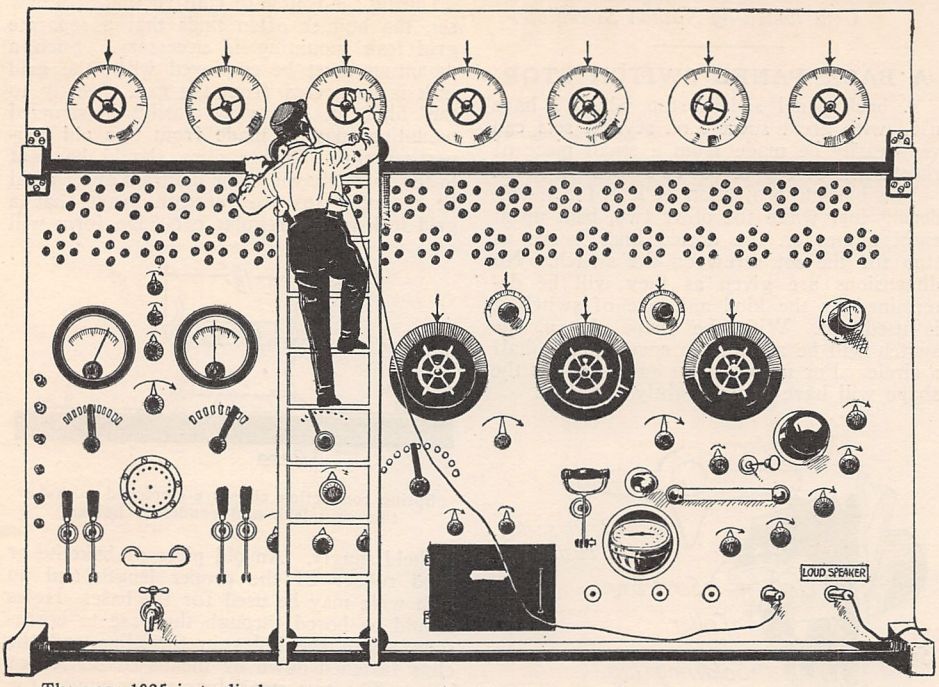
Attach the piece B in a similar manner on the other side of the roof. This will cross A at the ridgepole and extend upward in the opposite direction. The length pro-

(*Continued on page 729*)



An easily made antenna support constructed of two crossed sticks

Radio Humor



The year 1925 is to disclose many a new and radical form of radio receiver. Among the types for home use is the above chic model of the Double Mezzamined Hilicopter Pliodronotic Super Reflexed Monotrolic Receiver with hot and cold running water and hydraulic grid leak. It is super-controlled. A railed ladder permits access to the main tuning dials.

LETTER RE: RADIO

Dear Oscar:

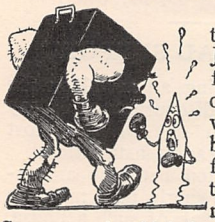
I received your recent letter in which you advised me to take up radio. Never darken my door again. I took up radio and they took me out. It was this way. Did you ever hear of the Stuperflexible circuit? My ex-friend Mr. Moskowitz of Izzy's Radio Shoppe (Pay Up At So Much Down) told me it was a good buy. So I said good-bye to two hundred and fifty hard-earned little ones and became the proud possessor of a Stuperflexible. This circuit, according to all I could gather from Moskowitz, is something on the order of a reflexed and neutralized super-heterodyne with a few modifications by Reinartz. The set employs nineteen tubes and each tube is surrounded on all sides by a balloon tire in order to absorb any obtrusive static. Another of the advantages of the set, Moskowitz said, is that any man of normal intelligence can assemble it with the aid of only a screw-driver. As I look back upon that remark I believe that he was casting dirty digs around the landscape because after fatally injuring nine screw-drivers I was compelled to have a radio mechanic put the Stuperflexible in working condition.

All's well that signs off well, as they say. So it was just midnight when I first listened in. The results were beyond my expectations. On all available kilocycles I heard

(*Continued on page* 764)

Radiotics

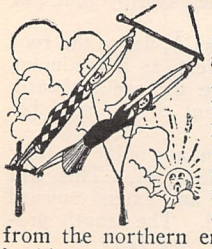
NOT A FAIR MATCH



The Radio Section of the Boston American of July 26th contains the following advise in one of its columns: "A six-volt storage battery may be used to FIGHT the filaments of UV-199 tubes provided a proper resistance is used." Someone should inform the S.P.C.A. of this. It is an uneven match and, as a rule, the filament gets licked. If such practice is continued the vacuum tube race will be wiped out.

Contributed by W. P. McLaughlin.

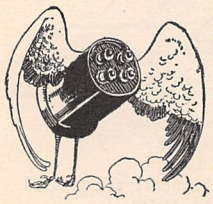
HUMAN AERIALS OF SNAPPY DIMENSIONS



In the Radio Section of the *New York Journal* of Saturday, August 2nd, we are informed that a Mr. Pierce "employs an aerial consisting of two WIVES, each *fifty feet long*, running north and south, with the lead-in from the northern end!" Good Lord, what is this world coming to? Is it not enough that the wife of today take care of the house and the children that she must be employed as a collector of radio signals? We should like to know whose wives Mr. Pierce employs and from what race they spring.

Contributed by H. E. Lovejoy.

ALL RADIO'S TRANSFORMERS GOT WINGS



The Barwick Company in the July, 1924, issue of Radio News advertise their "Tri-coil Radio Frequency AMPLIFLYING Transformers." Being gifted with flight we can understand how, by the use of them, one can hit the high spots in the ether jumble. The wings are, no doubt, made of bakelite.

Contributed by Earl Litt.

If you happen to see any humorous misprints in the press, we shall be glad to have you clip them out and send to us. No RADIOTIC will be accepted unless the printed original giving the name of the newspaper or magazine is submitted. Never mutilate clippings by underlining the misprint. We shall pay $2.00 for each RADIOTIC accepted and printed here. A few humorous lines from each correspondent should accompany each RADIOTIC. The most humorous ones will be printed. Address all RADIOTICS to

Editor RADIOTIC DEPARTMENT,
c/o Radio News

WHO WAS THE PRIMA DONNA?

From an evenings' list of Broadcast Programs in the *New York Journal* we found this unusual announcement: "WLW, Cincinnati. . . . 10:00 P. M.—Grand Opera from the Cincinnati Summer Opera Season at the ZOO!" Hot stuff, if true. The part of Faust was probably taken by the laughing Hyena, with an accompaniment from the monkey house!

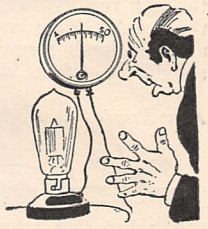
Contributed by J. E. Greenbaum.

WHO IS THE DAREDEVIL OPERATOR?

In the July 22 edition of the Los Angeles *Times* we are informed that "The installation in England of sending and receiving apparatus on the FLAGPOLE will enable Lieut. L. W. Smith to communicate at all times with the warcraft." What the advantage may be is a question. Maybe this arrangement keeps the "radio bugs" away from the apparatus.

Contributed by W. M. Clark.

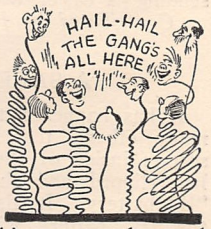
SUPPLIED WITH AND WITHOUT POWER HOUSES



In the August, 1924, issue of the Radio News the Rolls Royce Tube Co. advertise "Type 201A—5 v., 25 *amp.* Amplifier and Detector Tubes." That is probably why they call them Rolls Royce tubes. Only a millionaire can use them. However, a private power house could supply the necessary amperage, although if as many as eight of these tubes were employed, it would probably be necessary to connect two power houses in parallel.

Contributed by E. G. Pearson.

ALL THE BEST WAVES WILL BE THERE



In the July 24th edition of the Indianapolis *News* we struck a bit of inside news. It is stated that "The Bureau of Standards will radiocast standard *wave-lengths of frequencies* for the *celebration* of receiving sets and wave-meters." I believe this will be a big get-together and expect to be there with my Super Punkodyne, providing, of course, I can manage first to receive my allotment of "standard wave-lengths of frequencies."

Contributed by C. A. Rich.

NO BODY CAPACITY IN THIS SET

In an article in the August 19, 1924, issue of the *Evening Sun* (Baltimore) headed "The Importance of Shielding" we are informed that the metal shield for the receiver of the type mentioned should be approximately 100 FEET LONG. Quite a shield when one thinks it

(*Continued on page* 810)

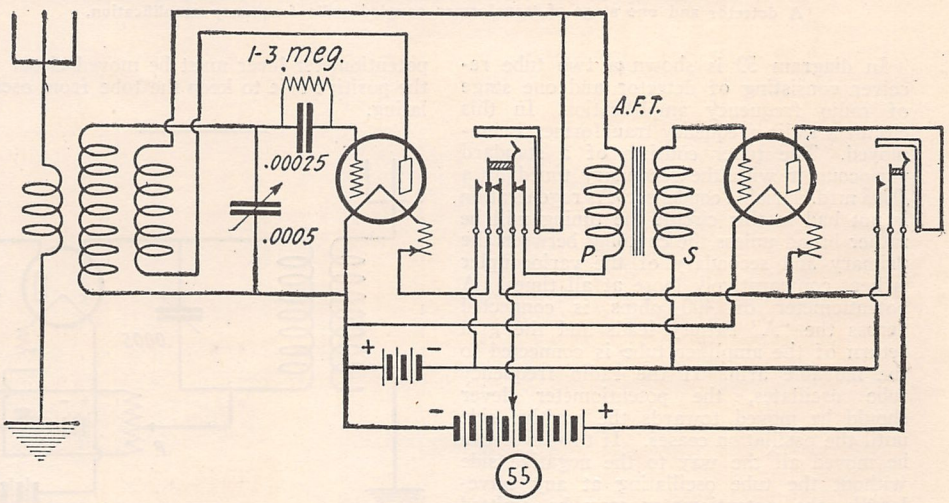
STANDARD HOOK-UPS

EVERY month we present here standard hook-ups which the Editors have tried out and which are known to give excellent results. This leaf has perforation marks on the left-hand margin and can be cut from the magazine and kept for further reference. These sheets can also be procured from us at the cost of 5c to pay for mailing charges.

RADIO NEWS has also prepared a handsome heavy cardboard binder into which these sheets may be fastened. This binder will be sent to any address, prepaid on receipt of 20c. In time there will be enough sheets to make a good-sized volume containing all important hook-ups. Every year an alphabetical index will be published enumerating and classifying the various hook-ups.

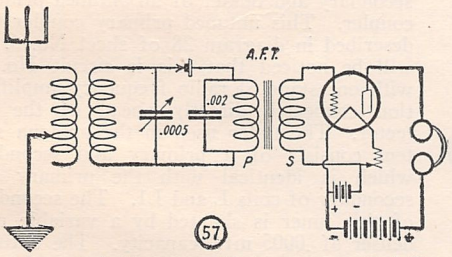
Handy Reference Data for the Experimenter

In diagram 55 is shown a regenerative circuit in conjunction with one stage of audio frequency amplification using filament control jacks. These jacks are very convenient, since, with their use it is unnecessary to turn off the filament current to the tubes not in use. A little study of this circuit will show that when the phones are plugged into the first jack, the detector tube alone lights up and when the phones are plugged in the second jack, both tubes are lighted. When the set is not in use it is only necessary to remove the plug and the filament current is automatically cut off. An untuned primary coupler is shown as the tuner in this circuit, although any type of tuner may be employed. A condenser of .0005 mfd. capacity is shunted across the secondary for tuning. Any type of receiving tube may be employed, providing the correct "A" battery voltage is used.



One stage of audio frequency amplification using filament control jacks.

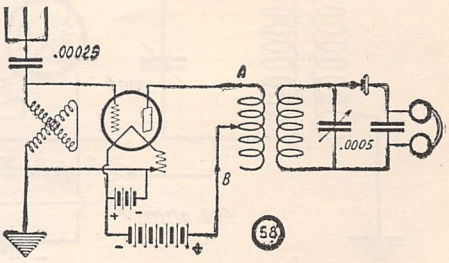
It sometimes happens that the primary of the audio frequency transformer burns out. In such cases the secondary may be used as a choke coil amplifier and when used in this connection will function extremely well. The volume obtained may not be as great as when a transformer is used, but the quality of reproduction will be excellent. A diagram showing a circuit employing such use of a transformer is given below as circuit 56. A double circuit jack is also incorporated so that the detector alone may be used when desired. A grid condenser must, of course, be employed in the grid circuit of the amplifying tube and has a capacity of .01 mfd. A grid leak of one megohm is connected from the grid of the tube directly to the negative of the "A" battery. In this circuit a variometer is shown as the tuner, and a .00025 mfd. condenser is placed in series with the antenna to lower the wave-length.



A crystal detector with one stage of A.F. amplification.

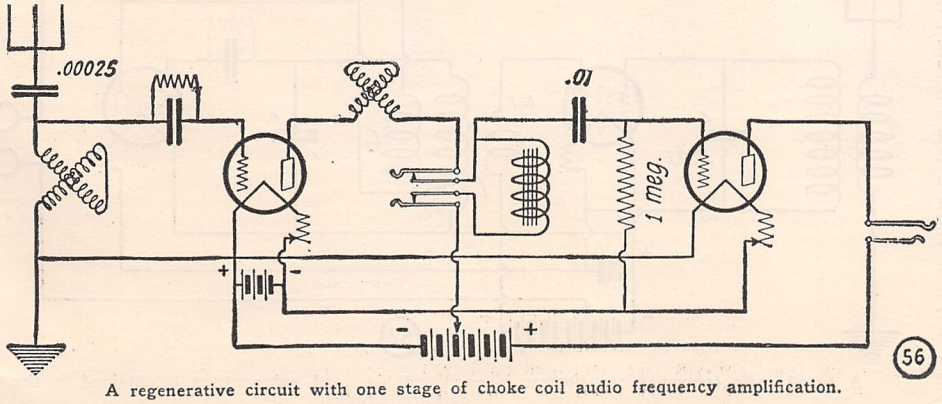
When local stations only are desired, and pure reproduction is wanted, a crystal receiver in conjunction with one stage of audio frequency amplification will give excellent results. Such a circuit is shown in diagram 57. A good audio frequency transformer with a ratio of not higher than 4½:1 should be employed. An amplifying tube such as the UV-201A or C-301A with a 6-volt "A" battery and a rheostat of 15 ohms will prove satisfactory. If desired, however, a UV-199 or a C-299 may be employed with three dry cells for the filament in series with a rheostat of 30 or 35 ohms. The "B" battery will be of 45 or 72 volts. An ordinary crystal receiving circuit is shown using a variocoupler for the tuner. A by-pass condenser of .002 mfd. capacity is connected across the primary of the audio frequency transformer. This circuit will give excellent results on all stations received.

When reception over greater distance is desired with a crystal receiver, a stage of radio frequency amplification may be placed directly before the receiver without altering the wiring in anyway, providing a variocoupler is used in the crystal receiver. A diagram of this circuit is shown as Circuit

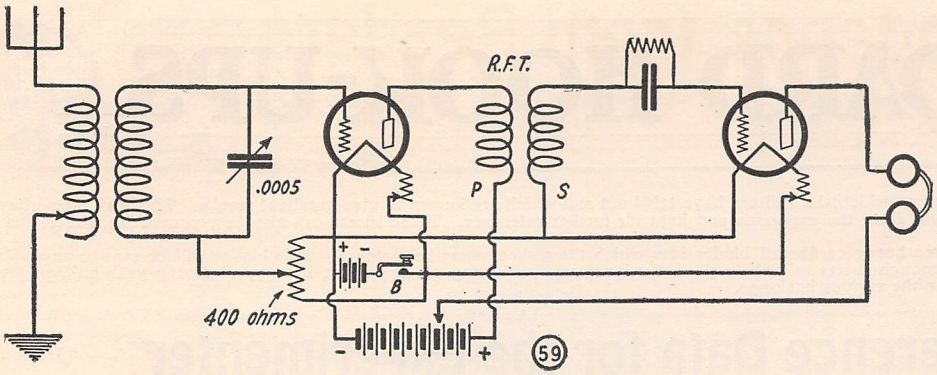


Crystal detector with one stage of R.F. amplification.

No. 58. The radio frequency amplifier consists of an amplifying tube and a tuner. The tuner in this case is an ordinary variometer with a .00025 mfd. condenser in the antenna circuit. The plate of the radio frequency tube is connected directly to the antenna binding post of the crystal set and the ground binding post is connected to the positive terminal of the "B" battery. No radio frequency transformer is employed, the variocoupler serving as a tuned radio frequency transformer. This method will prove superior as amplification is constant over the entire range. If the tube tends to oscillate, a smaller number of turns in the primary circuit of the variocoupler should be used. When tuning this receiver the variometer and secondary variable condenser should both be varied at the same time. It will be found that distance reception of the crystal receiver is greatly increased and the quality of reproduction is excellent.

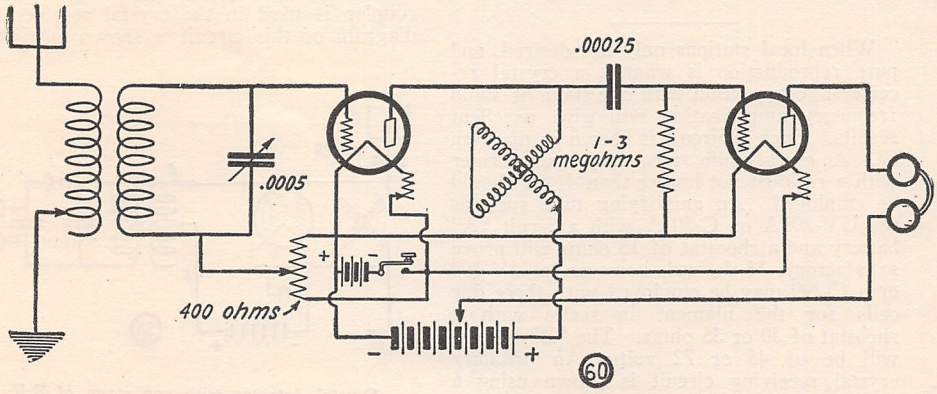


A regenerative circuit with one stage of choke coil audio frequency amplification.



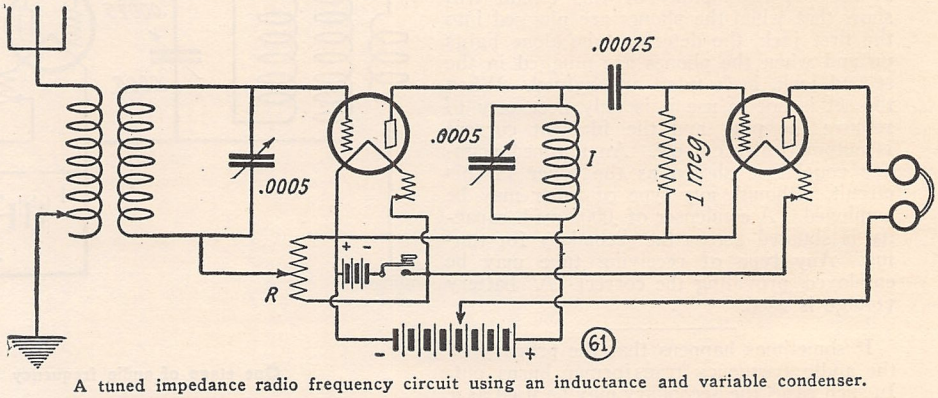
A detector and one stage of transformer coupled radio frequency amplification.

In diagram 59 is shown a two tube receiver consisting of detector and one stage of radio frequency amplification. In this circuit a radio frequency transformer is employed. The tuner consists of a standard variocoupler with the secondary tuned by a .0005 mfd. variable condenser. As regeneration is not had in this circuit the tuning will be rather broad unless the coupling between the primary and secondary of the variocoupler is kept comparatively loose at all times. A potentiometer of 400 ohms is connected across the "A" battery leads and the grid return of the amplifier tube is connected to the movable arm. If the radio frequency tube oscillates, the potentiometer lever should be moved towards the positive side until the oscillation ceases. If this lever can be moved all the way to the negative side without the tube oscillating at any wave-length, the potentiometer may be omitted and the grid return connected directly to the negative "A" battery. A filament switch shown at B is employed so tubes may be switched on or off and so the potentiometer will be disconnected when the set is not in use.



A selective radio frequency circuit using the tuned impedance method of amplification.

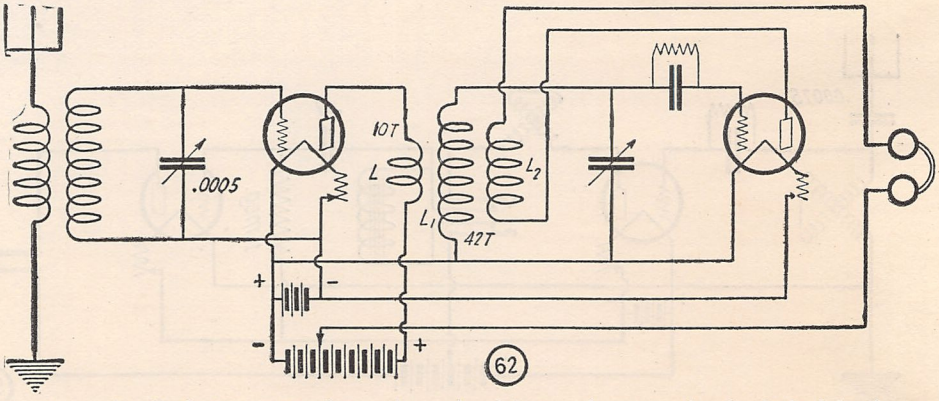
In diagram 60 is shown a radio frequency amplifier using the tuned impedance system of amplification. In this case the tuned impedance coil consists of a standard variometer connected in the plate circuit of the amplifying tube. A standard grid condenser of .00025 mfd. capacity is employed in the detector grid circuit, and the grid leak is connected from the grid directly to the positive lead of the "A" battery, as shown. In this circuit it is essential that a potentiometer be employed, as otherwise the radio frequency tube would be in a constant state of oscillation. This potentiometer should have a resistance of approximately 400 ohms. A filament switch is also connected in the negative "A" battery lead. The tuning of this receiver will be found fairly sharp. The secondary variable condenser of the tuner and the plate variometer must both be tuned to the same wave-length for any given station. It will be noticed that on the lower wave-lengths the potentiometer lever must be moved closer to the positive side to keep the tube from oscillating.



A tuned impedance radio frequency circuit using an inductance and variable condenser.

Diagram 61 shows another type of tuned impedance radio frequency amplification. In this case, instead of the variometer, a coil of wire shunted by a variable condenser is employed in the plate circuit of the amplifier. This coil, shown at I, may consist of 40 turns of No. 22 S. C. C. wire, wound on a tube 3½ inches in diameter. The variable condenser should have a capacity of .0005 mfd. This type of tuned impedance coupling will give slightly better results as regards sharpness of tuning than that described in diagram 60. The grid condenser has a capacity of .00025 mfd. and the grid leak has a resistance of one megohm. The potentiometer shown at R must be employed and should have a resistance of at least 400 ohms. A variocoupler is employed in this circuit, the secondary of which is shunted by a variable condenser of .0005 mfd. capacity. As a radio frequency tube in this type of circuit will oscillate very readily, great care should be taken that it is handled correctly so interference is not created in nearby receiving sets.

In diagram 62 is shown a radio frequency receiver which, if correctly built and operated, will give exceptional results. This receiver consists of one stage of tuned transformer coupled radio frequency amplification with regeneration in the detector circuit. The coils L, L1 and L2 are the primary, secondary and tickler of an untuned primary coupler. This untuned primary coupler was described in diagram 28 of sheet No. 6. It will be noticed that this is circuit No. 28 with one stage of radio frequency amplification connected directly ahead of the detector. The tuner used in the antenna system consists of a primary and secondary which is identical with the primary and secondary of coils L and L1. The secondary of this tuner is shunted by a variable condenser of .0005 mfd. capacity. The untuned primary coupler secondary must also be tuned with a condenser of the same capacity. Both condensers must be tuned to the same wave-length to receive any station. As the regeneration obtained in the detector circuit is equal to an extra stage of radio frequency amplification, this receiver will duplicate the results of most three tube sets. No potentiometer is required in this receiver.



A tuned radio frequency transformer is employed here and regeneration is obtained in the detector circuit.

Correspondence from Readers

RE: MR. MORRELL'S LETTER

Editor, RADIO NEWS:

In connection with the article by Peter Morrell, of Wilmington, Del., in the September issue re: amateur interference with broadcast listeners:

About all that we Radio Supervisors and inspectors can do about the matter is to sit back, helpless, and cry: "Oh, Lord, how long" will it be before some of these people awaken to the fact that when C.W. transmitters are used, interference on broadcast waves cannot, simply cannot, take place if the receiver tunes reasonably sharp. A transmitter operating on, say, 200 meters, simply isn't transmitting on three or four hundred at the same time. The trouble is that the receiver, through defects in its design or construction, is tuning in such a broad band of wave-lengths that it also catches the wave of the C.W. transmitter, even though adjusted for broadcast reception. Use a coupled circuit receiver, or if you have a single circuit, add a tuned primary to it as has often been described in RADIO NEWS. Have no fear that it will weaken the signals.

The reason any attempt by any association to prevent amateur C.W. transmission has fallen through is because such a step would not be in accord with the fundamental principles of liberty and democracy. Imagine forbiddinig a person doing something just because it might annoy some people if the latter are careless! A more humane idea would be to forbid railroads operating because of the large number who get killed racing trains to grade crossings.

H. S. GOWAN,
120 West King Street, Kitchener, Ontario.

THE EFFECT OF FOG ON RADIO SIGNALS

Editor, RADIO NEWS:

I read with interest Mr. Kubiac's article in your August number regarding the effect of fog upon radio signals. However, I live less than 10 miles from the ocean, in Northern California, and we have fog almost every night. I have been making a few observations and find that my results are exactly opposite.

I am about 500 miles, air line, from Los Angeles. On clear nights I am hardly able to understand the announcements from KFI and KHJ and indeed at times I am not able to get them at all. On the other hand when it is foggy they come in on the loud speaker with reasonable volume.

I am not familiar with the technical side of either fog or static, so I cannot enter into a deep discussion of the whys and wherefores with 3ZZ, but I would appreciate an explanation of this phenomenon.

EUGENE BULTON,
Ft. Bragg, Calif.

FROM A CRYSTAL ENTHUSIAST

Editor, RADIO NEWS:

In the July issue of RADIO NEWS, directions for building a crystal set were given. I built this set, making my own coil, detector, condenser, aerial and cabinet. My father did not think it would work and a radio expert said I would spend $10 and would get nothing in return. My aerial was No. 14 stranded wire insulated. The first night I received nothing and thought my $1.50, as that was all it cost me, was wasted. The second night I began receiving and in one week I had the following stations listed:

WEAF	New York	40 miles
WJZ	New York	40 miles
WOR	New Jersey	45 miles
WHN	New York	40 miles
KDKA	Pittsburgh	350 miles
WGY	Schenectady	170 miles
WNYC	New York	40 miles.

I also received Davis' and Coolidge's speech clearly. If any one wants a good set I advise them to construct the RADIO NEWS Beginner's Set.

EDWARD ALSON,
Amityville, N. Y.

IN ANSWER TO MR. MORRELL

Editor, RADIO NEWS:

I am prompted to write a protest in answer to a communication by one Peter Morrell of Wilmington, Delaware, writing in your "Correspondence from Readers" columns for September. I trust you will find it convenient to give space to this letter, in the hope that it may set Mr. Morrell, and hundreds of thousands of others of the same mind, straight.

His communication attacks the U. S. Department of Commerce Radio Inspectional service, and is directed chiefly against the

40 Non-Technical Radio Articles

every month for the beginner, the layman and those who like radio from the non-technical side.

SCIENCE & INVENTION, which can be bought at any newsstand, contains the largest and most interesting section of radio articles of any non-radio magazine in existence.

Plenty of "How To Make It" radio articles and plenty of simplified hook-ups for the layman and experimenter. The radio section of SCIENCE & INVENTION is so good that many RADIO NEWS readers buy it solely for this feature.

List of Radio Articles Appearing in the November Issue of "Science and Invention"

What's New In Radio.
How to Build A Short Wave Set
—By A. R. Marcy, 2DK.
New Solodyne Circuits.
R. F. Amplification, Regeneration and Reflex Set Combined.
Airplane and Train Radio.
Radio Oracle.
Neutralizing Methods
—By Leon L. Adelman, 2AFS.
Radio Wrinkles.

"Supervisor of Radio for the Atlantic Coast." Inasmuch as there are three such officers, in addition to the Chiefs in Washington, it is not known which Supervisor Mr. Morrell refers to, but his opinions are general enough to include them all.

We'll eliminate the amateur element from this discussion inasmuch as Mr. Morrell makes rather light of this interference, which is in reality a very great deal less than is popularly supposed. Let us consider then his protest against ship stations operating during the broadcasting of such an event as the recent political Convention at Cleveland.

Mr. Morrell, if his receiving equipment is located at his Wilmington home, is, of course, in the area that experiences a great deal of annoying interference from ship stations, as well as commercial and Naval shore stations. It appears to be a question as to whether he considers the primary purpose of radio communication—the safety of lives and property at sea—as secondary to the enjoyment of some ballyhoo broadcasting, which is exactly what these political conventions amount to. Apparently, in Mr. Morrell's own mind, he is satisfied that a ship in distress must not be permitted to interrupt what he doubtless considers a keen pleasure. He is not alone; in this super-civilization in which we live, there are millions like him. I cannot of course, state emphatically that it *was* a ship in distress; but it *might* have been. Furthermore, very few vessels are found transmitting matter on the high seas today which is not of considerable importance to commerce or navigation.

Suppose it was superfluous matter that the vessel was transmitting—though how it could have been of less value than the "hogwash" of "Hurrahs" and thick-tongued humor (?) of the political broadcast, I fail to see—was it his cue to submit to you a caustic letter berating the Supervisor of Radio? Just such action as this is what makes it impossible to gain but little assistance from the radio public and properly suppress needless interference. Mr. Morrell should have directed a respectful letter to the Supervisor at New York or Baltimore, setting forth the facts, giving the call letters of the vessel, the time and date of the transmission, and enough of the transmitted matter to enable identification. This would have been simple, if Mr. Morrell's code ability is what he claims. He would in return have received a courteous acknowledgement from Mr. Batcheller or Mr. Cadmus, and in its quiet way, the Department of Commerce would have investigated and taken suitable action, if warranted.

It is just such an attitude as you have adopted, Mr. Morrell, that prevents you of the great listening public receiving full value from your radio equipment. You don't stop to realize that there are 2800 American vessels equipped with radio, 20,000 amateur stations and 500 odd broadcasters, besides naval and commercial shore stations and there are *less than 50* men in the Radio Inspectional service to look after all these interests in addition to those of five million broadcast listeners! It's entirely your fault—no agitation or pressure has been brought to bear on your Representatives at Washington and consequently they refuse to appropriate sufficient money to give you an inspection service large enough to adequately handle the situation. Yet you expect your Supervisors to listen in nightly, after ten or twelve hours at the office and on the road, and catch *every* offending transmission in the air! Do you know that the majority of the Supervisors and their assistants *do* listen in *nightly,* and *voluntarily* with apparatus purchased *from their own personal funds* on inadequate salaries, just to help you?

You'll not get a reply from the Department or its representatives to your communication. They are too busy helping those who appreciate their almost colossal efforts. But I want to suggest that you investigate the activities of the Radio Inspectional Service of the Department of Commerce—you'll be surprised at the loyalty and devotion to duty you'll find. I know whereof I speak; I have just recently resigned as an Assistant to one of the Supervisors of our second largest district; I couldn't stand the pace; too many of your kind were driving me to dark thoughts.

HOWARD S. PYLE,
2906 Montclair Ave.,
Detroit, Mich.

THE REDUCING OF STATIC INTERFERENCE

Editor, RADIO NEWS:

I saw in your "Correspondence from Readers" department, in a recent issue, certain data regarding the elimination of static by the reduction of plate voltage. This is the only simple and effective way of reducing static, and applies to the regenerative, multi-stage radio frequency and Super-Heterodyne receivers. To secure good loud speaker volume with static reduction three to five stages of distortionless audio frequency am-

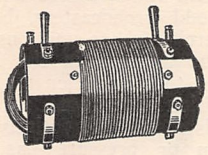
(*Continued on page* 744)

RADIO manufacturers are invited to send to RADIO NEWS LABORATORIES, samples of their products for test. It does not matter whether or not they advertise in RADIO NEWS, the RADIO NEWS LABORATORIES being an independent organization, with the improvement of radio apparatus as its aim. If, after being tested, the instruments submitted prove to be built according to modern radio engineering practice, they will each be awarded a certificate of merit, and a "write-up" such as those given below will appear in this department of RADIO NEWS. If the apparatus does not pass the Laboratories tests, it will be returned to the manufacturers with suggestions for improvements. No "write-ups" sent by manufacturers are published on these pages, and only apparatus which has been tested by the Laboratories and found to be of good mechanical and electrical construction is described. Inasmuch as the service of the RADIO NEWS LABORATORIES is free to all manufacturers whether they are advertisers or not, it is necessary that all goods to be tested be forwarded prepaid, otherwise they cannot be accepted by the Laboratories. Address all communications and all parcels to RADIO NEWS LABORATORIES, 53 Park Place, New York City.

Apparatus Awarded Certificates

CARCO TUNING UNIT

The Carco tuning unit, also called the "ham special coupler," is designed for short wave-lengths. This coupler employs primary, secondary and tickler windings. The primary and secondary windings have two No. 16 wires in parallel so as to obtain a low radio frequency resistance. The primary is wound on one rotor and employs six turns. The secondary of 24 turns is wound on the outside tube. The tickler has



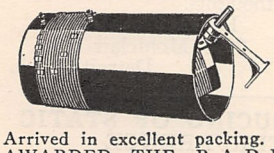
32 turns of No. 24 wire. Excellent results were obtained on this coupler on wave-lengths from 70 to 250 meters, although the range depends largely upon the type of variable condenser used. Manufactured by the Carter Mfg. Co., 1728 Coit Avenue, E. Cleveland, Ohio.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 547.

TERLEE TYPE R VARIO-COUPLER

This variocoupler is designed especially for use with radio frequency amplifier circuits. The primary employs 66 turns of No. 22 wire wound on a four-inch tube. It is provided with taps. The secondary comprises 62 turns of Litz wire wound on a 2¾-inch tube mounted at an angle so as to obtain 180 degree coupling. The outer tube is 6¾ inches long so that very loose coupling between the primary and secondary coils is obtained. It tunes from 200 to 650 meters with a .0005 mfd. variable condenser connected across the secondary. Manufactured by the Terlee Elec. and Mfg. Co., 443 So. Dearborn St., Chicago, Ill.

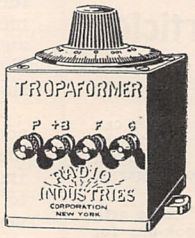


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 545.

TROPAFORMER

The Tropaformer is simply a tuned long wave radio frequency amplifying transformer. It may be used in any Super-Heterodyne or other receiver where a long wave amplifier is required. It consists of an iron core transformer and variable condenser combined in one instrument that covers a wave-length range of 3,000 to 10,000 meters. This not only allows each stage of the intermediate amplifier



to be correctly adjusted to a definite wave-length, but the advantages of either high or low intermediate frequencies can be had. The selectivity is so great that no special input coupler is required. The case is entirely of hard rubber. Manufactured by the Radio Industries Corp., 131 Duane Street, New York City.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 552.

TRI-JACK

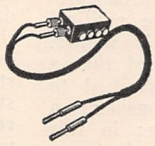
The Tri-jack, manufactured by the Brooklyn Metal Stamping Co., 718 Atlantic Avenue, Brooklyn, is small in size and has low capacity. It measures one inch in diameter and extends 1⅛ inches behind the panel. Any standard telephone plug fits this double circuit jack; phosphor bronze springs make connections with the plug.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 536.

MAR-CO MULTI-CONNECTOR

The Mar-Co multi-connector, manufactured by the Martin-Copeland Co., Providence, R. I., is of similar construction to the multi-plug described elsewhere in these columns. Instead of a plug the multi-connector has a 15-inch telephone cord attached to it. By attaching this cord to a standard plug, the connector may be used with any set. Any number of head sets from one to four may be used.

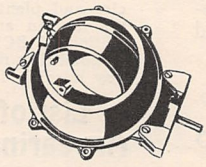


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 543.

GOODRICH VARIOMETER

The Goodrich variometer is furnished unwound and in knocked down condition. The parts are of hard rubber of the standard size and design. The form is designed for both panel and base mounting. It may be wound to suit individual requirements, after which the instrument is easily assembled by following the instructions furnished. It is equipped with a ¼-inch shaft



and has stops allowing a 180 degree movement. Manufactured by the B. F. Goodrich Rubber Co., Akron, Ohio.

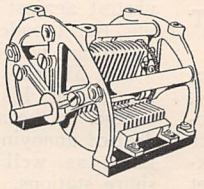
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 548.

FLEWELLING CONDENSER

The Flewelling Type R condenser is of the grounded rotor type with die cast plates of accurate mechanical construction. This condenser has exceptionally low losses and low minimum capacity. The minimum capacity is 7.32 mmf. and the maximum capacity 482.33 mmf. The losses with the condenser set at maximum capacity were so low that they could not be accurately measured at 1,000 cycles. The instrument is designed for panel or base mounting. Manufactured by the Buell Mfg. Co., 2973 College Grove Ave., Chicago, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 534.



MYERS TUBE

The Myers tubes are made in two types. The dry cell type and the universal type. The dry cell type consumes ¼ ampere at 2½ volts and is operated from two dry cells. The universal type requires three dry cells or a storage battery for lighting its filament. Two of each were submitted by the Curtis Sales Corp., 43 East 28th St., N. Y. C. The amplification factor of both types varies from 9 to 13. The tubes are furnished with small brackets for mounting, as they do not fit the standard V. T. socket.

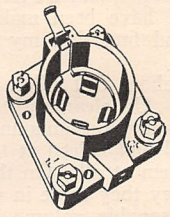
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 550.

GOODRICH V. T. SOCKET

The Goodrich vacuum tube socket is made of hard rubber and is fitted with a spring catch for holding the vacuum tube instead of the usual bayonet slot. The tube is slipped into the socket until the spring catches over the pin. To remove the tube, simply depress the spring and lift the tube. Phosphor bronze springs make contact with the prongs of the vacuum tube. It is designed for both panel and base mounting. Manufactured by the B. F. Goodrich Rubber Co., Akron, Ohio.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 549.



ACMEFLEX

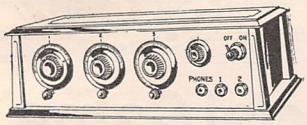
The Acme Apparatus Co., Cambridge, Mass., submitted one of their assembled Acmeflex kits. This receiver, although, simple in construction as the illustration shows, is highly efficient. It employs four tubes, reflexed so as to obtain three stages of radio amplification, crystal detector, and three stages of audio amplification. Acme audio and radio transformers are used in the set, which instruments have been approved by us. Their well-known low loss condenser is used to tune the loop circuit. Any loop designed for broadcast reception may be used. The instruments are mounted on a 7x21-inch panel. Excellent results were obtained from this receiver and no trouble was experienced from howling so common to many reflex receivers.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 540.

PFANSTIEHL MODEL 7 RECEIVER

This receiver is of the five tube type employing two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Low loss spider-web coils are used for the tuned R.F. transformers. These are mounted at an angle so as to reduce coupling between stages. Metallic shields are also placed between the



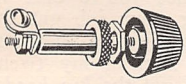
condensers. The entire receiver is of excellent construction and of neat appearance. Very good results were obtained from it when using the average size outdoor aerial. Manufactured by the Pfanstiehl Radio Service Co., Highland Park, Ill.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 539.

MARSHALL-STAT

This rheostat, of the carbon compression type, is of very small construction. It has a resistance range of ½ to 10 ohms with five turns of the knob. It safely carries one ampere without excessive heating. The metal casing is nickel plated



and the knob is one inch in diameter. Manufactured by the Marshall Elec. Co., 3225 Locust Blvd., St. Louis, Mo.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 553.

MAR-CO RADIO JACK

The Mar-Co Radio Jack is of the conventional design with slight improvements. The soldering lugs are bent around so as to hold the connections more firmly. An insulating strip extends the whole length of the two inside contact springs, so as to make a short circuit impossible. The jack is of very durable

construction. Manufactured by the Martin-Copeland Co., Providence, Rhode Island.

Arrived in excellent packing.

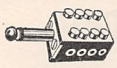
AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 541.

MAR-CO MULTI PLUG

The Mar-Co Multi plug is similar to the standard telephone plug except that it is arranged with eight binding posts so that four head sets may be used at once. The head sets may be connected in series, multiple, or series-multiple. The construction of the plug is very good. Manufactured by the Martin-Copeland Co., Providence, Rhode Island.

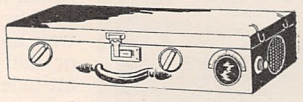
Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 542.



ZENITH RADIO COMPANION

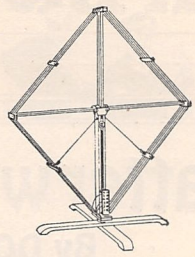
The Zenith Radio Companion is a complete six-tube portable radio receiver about the size of the average suitcase. The loop aerial and loud speaker are contained in the casing and all that is necessary to operate the set is to pull the filament switch and turn the condenser dial. The set employs three stages of radio frequency amplification, detector and two stages of audio amplification. Type UV-199 tubes are used, with three standard dry cells for the "A" battery. Excellent results were obtained on this receiver on stations within 100 miles. For long distance reception, two connections are provided for attaching to a larger antenna. Manufactured by the Zenith Radio Corp., 328 South Michigan Ave., Chicago, Ill.



AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 537.

AMPLIFEX LOOP AERIAL

The Amplifex loop aerial is of elaborate construction and pleasing appearance. The wire is wound on a mahogany frame which may be folded. A compass mounted in the base helps in determining the direction in which the loop should be pointed. There are 13 turns in all with six binding posts so arranged that either three, four, six, nine, 10 or the total 13 turns may be used separately. With this arrangement practically all wavelength ranges now used in broadcast reception may be covered. Manufactured by the Amplifex Radio Corp., 35 Mass. Ave., Arlington, Mass.

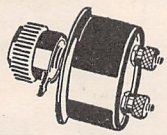


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 535.

MAR-CO BATTERY SWITCH

The battery switch manufactured by the Martin-Copeland Co., Providence, R. I., is small in size and has a quick make and break knife action. An "on" and "off" name plate is furnished with this switch. It is of very neat appearance and only requires one hole for mounting.

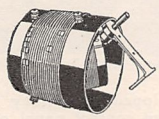


Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 544.

TERLEE TYPE S VARIO-COUPLER

The Terlee type S variocoupler, also manufactured by the Terlee Elec. & Mfg. Co., 443 S. Dearborn Street, Chicago, Ill., is of similar construction to the type R coupler described above. The outside tube



of this coupler is four inches long, enabling close coupling between the primary and secondary windings. This coupler is designed for any of the standard detector circuits now in use.

Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 546.

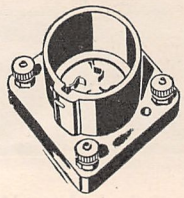
SEA TONE REPRODUCER

The tendency in the design in loud speakers is to make them more ornamental. The Sea Tone reproducer, shown in the illustration, is very ornamental and serves the purpose of a table lamp as well as a loud speaker. A sea shell is used for the horn. A small 110-volt lamp is fitted inside of the shell. A very good phone unit is contained in the base. This unit reproduces concerts with exceptionally good volume and quality. Manufactured by the Tonks Bros. Co.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 538.

PIONEER V. T. SOCKET

The Pioneer V. T. Socket is of very simple construction and makes excellent contacts with the vacuum tube. The form is of moulded bakelite and the spring contacts make connections with the sides of the vacuum tube prongs. Rugged binding posts are provided on this socket. It is manufactured by the Pioneer Radio Corp., Galesburg, Ill.



Arrived in excellent packing.

AWARDED THE RADIO NEWS LABORATORIES CERTIFICATE OF MERIT NO. 551.

Ask Hoover! He'll Do It

APPARENTLY many fans and owners of broadcast and amateur stations believe that Herbert Hoover can do anything, judging from the curious requests reaching the head of the Commerce Department or the desk of his aide, Chief Supervisor of Radio W. D. Terrell.

Almost every day some unusual letter comes to radio headquarters at Washington or is forwarded from a District Supervisor. The last question, which caused considerable commotion, came over the telephone. It was: "What kind of a detector should be used on a crystal set?" Here is another: "In building a 'blank' set should the capacity of my condenser be one or two quarts?" Technical questions when practical are answered, but the Commerce officials are supposed to handle administrative matters only and are kept busy at that.

Many broadcasters want their initial as the call letters for their stations, not realizing that this country is assigned only three initial letters, W, K, and N, by the international Berne bureau. Even then, we do not get all the calls beginning with these letters; part of the K calls are assigned abroad. If one's first name begins with one of these three letters there is one chance in a million that the other letters can be found among the unused calls. There are 4,812 calls in use today out of a possible 50,000 combinations.

Some of the broadcasters were lucky and got call letters which were significant of their names. It began when the official who designates call letters, assigned KOP as the call of the Detroit police station. Then came the Radio Corporation station in Washington, which selected the abandoned ship call WRC, indicative of Washington Radio Corporation; WRCA was not available. The Chesapeake and Potomac Telephone Company succeeded in getting WCAP, equally significant of its location and name. WNP—Wireless North Pole, was given MacMillan for his polar cruise. Later on, WGN was assigned to the Chicago *Tribune*, which uses "World's Greatest Newspaper" as a slogan, and, finally, WNYC was granted as the official call of the New York municipal transmitting station.

Some broadcasters also desire exclusive wave-lengths, regardless of whether or not they can qualify as high-powered class B stations, or whether the wave-lengths in their zones are already assigned on a time basis between two or three stations.

A number of amateurs who own powerful transmitters want international call letters, so they can be identified abroad. This question will soon have to be taken up internationally. Our 16,545 amateur calls, all prefaced by a figure significant of the district, are similar to those of amateurs of other nations. This is sure to cause confusion if long distance work continues to extend beyond the boundaries of individual countries. Owners of receiving sets often ask that notices of lost relatives and even pets be broadcast. The first has been done with success. The only lost pet reported as found by radio broadcast, however, was the White House cat, although perhaps Commissioner Carson's mules, which were returned soon after their description was broadcast, also come in this category.

Correspondents of the radio section have asked for special codes and languages; one individual offering to show the Secretary Hoover an entirely new method of international communication by a universal code.

Although broadcasters have agreed unanimously to refrain from broadcasting pure advertising, some stations seem a bit uncertain as to just where to draw the line, so this question arises again. Fortunately the Department was not forced to forbid the broadcasting of criminal trials and such proceedings, due to the fact that a learned judge saw fit to keep such matters off the air.

It is seen that not all the questions are

(*Continued on page* 808)

"What's the Matter with the Commercial Game"

By DONALD J. PETER

One of the "old stand-by" stations fully equipped with navy apparatus. The receiver is the faithful S.E. 143 with a DeForest vacuum tube control panel of early design. The transmitter is similar to the ones a number of boys are playing with now (self cleaning quenched gap an' everythin!!) except it is a 5-KW affair.

I USED to be a HAM; I had halves in 6BRS for a while until I left High School, then I had halves in 6BEO and later I wanted to see what the wide, wide world looked like, so I went to sea to find out.

I located myself on a big husky freighter named the *Mosella* and I was known as "Sparks" by the crew. I was there about two weeks when I felt the importance of my job start working on me, I was continually flooded with questions every day, sparks who's around us, what ship was that which passed us this morning. Did you get any press news last night, what was it all about?" Just such things as that, and of course, being young and ambitious I had to stop and tell them all about it. Under such strains as these I was soon parading the deck with my nose at such an angle that the rain drops could have easily dropped in had it been raining. This sort of thing went on for some time and the best of it was I got away with it. About this time I was beginning to feel that the Mates and other Officers on board were mere trifles compared to myself, and was actually getting so that I didn't even speak civily to them and although unnoticed by myself I was losing many good friends.

One day in Manila while the "Gooks" were unloading the ship a heavy cloudburst smothered the work and I made for the salon deck to avoid getting my newly pressed uniform wet. I planted myself in one of the wicker chairs on deck of which there were only two. Shortly afterwards the "Old Man" and the Chief Engineer came up. Upon arrival the Chief Engineer peered out into the rain, while the "Old Man" looked at me and very pleasantly remarked, *"Now sparks if you'll get out of that chair and get the hell up where you belong and stay there* Mr. Kidd and I will sit down." That was the finish, it was enough to finish every spurt of ambition I had ever been known to have.

I "got the hell up where I belonged" all right but when I did I somehow felt as though I had been badly treated, in fact I didn't see where I had done anything to make him talk like that to me, but after thinking the subject over I decided that I wouldn't give him another opportunity to talk to me in that manner. So for the remainder of the stay in Manila and likewise the remainder of the trip I stayed in my room continually, except at meal times and during working hours.

A few days out of Manila an old fellow named Woods, evidentally my one remaining friend came up to see me, "Why don't you ever come out on deck any more Sparks," was question No. 1. With my eyes half closed from a previous siesta I looked up and inquired, "Who let you out?" rather sarcastically, but still I was so disgusted that I didn't care whether I spoke to any one or not. "Oh I just came up to find out why you have shut yourself up. Was it the remark the Skipper made in Manila?"

"How did you find out what the Old Man said?" I asked.

"I was standing just around the corner when he said it," replied Woods.

"Well I'll tell you Woods that's the reason all right. But still, you know I can't figure out any reason—"

"Oh yes Sparks," Woods broke in, "I've been noticing your attitude pretty closely and the best I can say for you is that you've ruined all the chance you've ever had on this boat by letting your job get the best of you. You've done just as all the rest of the beginners I've seen in my twenty-five years at sea, you've got the *big head.*"

"Whadayamean I've got the big head?"

"Oh yes, Sparks, I've noticed it in the last few weeks that when you get into a conversation it's nothing but I, I, I, I, I, I, until all Hell won't have it, and when you get that way no one cares whether they talk to you or not. Why don't you try changing your attitude a little because its sure stuff you'll never get along the way your going."

"Well Woods I'll tell you I don't really see anything wrong, but I'll think it over."

"All right Sparks, you do that and see if you don't get along a whole lot better." With that my friend Woods left me to dope out something that was as good as impossible for me to see. But after many days' deep thinking I decided to change my attitude, in fact I had to do something for I had no more friends and I might just as well try that for a remedy as anything.

Upon arrival in 'Frisco I solemly paraded up to the Old Man and told him I was going to quit. I did it in such a manner as to keep him from thinking that what he had said was the cause of my leaving. And I don't know to this day whether he ever knew why I left. Later I located myself on the *Thomas* (WXM), all ready to try out a new idea of life. I made it go for a complete round trip, and believe me, I soon realized where I had made my mistake on the *Mosella.* I was well known, every one spoke to me, especially in the morning when I came in to breakfast. All blushing and set I would blossom into the "chow hall" and get a cheerful "good morning Sparks." Those words just buzzed around in my international morse decoding box like a bee in a new hive.

But, on January 26, 1924, on the return trip from Nagasaki, Japan, to 'Frisco I got all roused up gaain. It was about 6 a. m. I was sitting in the shack peacefully hearing nothing but a little static and the beautiful way my set oscillated when I heard a very faint "QST-SS MARY HARLOCK Lat. 46.35 N. Long. 178.3 E. will some one please stand by deck load of lumber shifting QST de GBNZK k." I listened but no one answered, so I broke in and gave the Limy my TR. I was shaking like an old man of about ninety. I also told him to QRX for particulars. The Limy answered with steady hand and set good stuff. Being quite satisfied with his answer I went up to the Old Man.

(*Continued on page* 754)

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can publish only such matter as is of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you will make your letter as brief as possible.

McCALL CIRCUIT

(2036) Mr. James Holburn, Winston, Mass., asks:

Q. 1. Please give diagram and constructional details for the McCall set.

A. 1. The circuit, with data, is shown in these columns. The exact number of turns required must be determined by experiment. The secondary, over which the primary is wound, has its winding on a tube about 2¾ inches in diameter. The primary is wound directly over the secondary. All coils are wound in the same direction. Number 26 D. C. C. wire may be used throughout. Absorption coils "A" are wound on a tube of a size that will just slip inside the secondary coil. Each coil is shorted, as shown. The position of each coil is determined by experiment. Should the location of the tubes be changed, or new ones put in the set, it will be necessary to change the position of the absorbtion coils accordingly. This circuit resembles the standard Neutrodyne arrangement. Indeed, standard neutroformers may be used for the radio frequency coils. Further, this circuit is subject to the ramifications of all other circuits employing the type of transformers usable in this set.

Q. 2. What is the cubical contents of air of the standard Western Electric loud speaker horn?

A. 2. Approximately 488 cubic inches.

Q. 3. What tubes should be used in the McCall Circuit?

A. 3. Any tubes designed for amplification or detection may be used in their respective positions.

MULTI-ELEMENT TUBES

(2037) Mr. W. Thibault, Portland, Oregon, wants to know:

Q. 1. What are the usual elements in a four-element tube?

A. 1. One filament, two grids and one plate.

Q. 2. What are the usual elements in a five-element tube?

A. 2. One filament, two grids and two plates.

Q. 3. What are the advantages of a four element tube over the usual three element ones?

A. 3. By the use of additional elements in the vacuum, in relation to a common filament, it is possible to combine several different actions in one tube ordinarily requiring two or more tubes. Battery consumption may often be reduced by using such a tube.

SPECIAL TUBES

(2038) Mr. D. A. Shafer, Stroudsburg, Pa., writes:

Q. 1. Is a special socket required for four element tubes?

A. 1. A special socket is sometimes required, but it is ordinarily possible to use the metal shell of the socket as the one additional connection.

Q. 2. Is there a six element tube?

A. 2. A six element tube, comprising one filament, two grids and three plates was recently developed for use in a transmitting circuit, but its further development has been abandoned. We do not know of the practical application of a six element tube in receiving circuits.

LITZ

(2039) Mr. R. Bob Miga, Manton, R. I., requests:

Q. 1. What is the principle for constructing a non-inductive resistance, using wire?

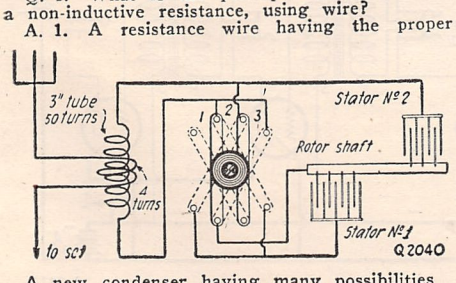
A. 1. A resistance wire having the proper length, is doubled once. This doubled wire is then wound as though it were a single wire of double the length. The connections are made to the two free ends.

Q. 2. Is there any way a burned-out transformer may be used in a set? It is an audio frequency transformer with an open circuit in the primary.

A. 2. The good winding of such a transformer may well be used as the choke coil in such a circuit as is shown in answer to question No. 2015 which appears in the September issue of this magazine.

Q. 3. What is the meaning of "36 x 36 Litz?"

A. 3. This means that 36 strands of No. 36 B. & S. gauge enameled wire are constituting stranded cable or wire called "Litzendraht."



A new condenser having many possibilities is shown arranged for any one of three capacities. It may be used in any circuit requiring a condenser of one of these ranges.

NEW CONDENSER

(2040) Mr. Sebastian Holland, Plainfield, N. J., asks:

Q. 1. Where may the new condenser having two rotors on one shaft and two separate stators, giving the effect of two variable condensers with a single control dial, be purchased?

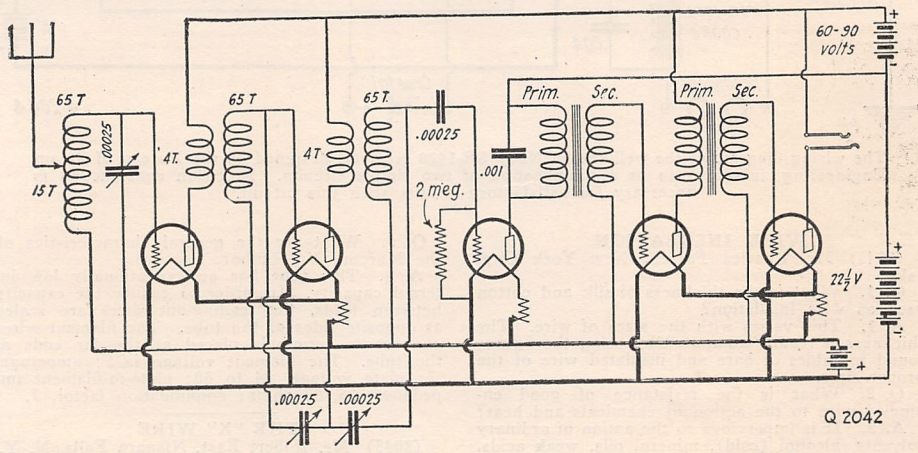
A. 1. This information may be had by addressing a letter to this department, enclosing a stamped envelope or a return post card.

Q. 2. In what way could the advantages of this condenser be best utilized, in the construction of a wavemeter?

A. 2. We are showing a diagram of the instrument you request. With the switch in position No. 1, the maximum capacity is .000125 mfd. (condensers in series). Position No. 2, .00025 mfd. (one condenser only, being used). Position No. 3, .0005 mfd. (condensers in parallel). It will be necessary to send the instrument to some laboratory, such as that of the Bureau of Standards, Washington, D. C., for calibration, unless you have some means of accurately adjusting the instrument. The primary coil may be directly over the secondary, separated by oiled paper, paraffined paper, shellacked paper, Empire cloth, tape, or strips of wood, hard rubber, glass, mica, or bakelite insulation. Use about No. 18 insulated wire.

Q. 3. How may this condenser be used in a wave trap?

A. 3. Practically the same construction is followed. The connections remain the same as for the wave meter diagram. Instead of four turns, 12 to 14 turns may be used in the primary coil. The best type of coil construction is that described in the July, 1924, issue of RADIO NEWS, on page 55. The rotor need only be used for experimental work. Since these special coils are now on the market, we shall be glad to furnish the name and address of the manufacturer, upon request.



While the electrical connections remain the same, the controls of this set have been reduced to two by the use of a new condenser having two rotors on one shaft, with two separate stators. Low-loss instruments are a necessity in this set, due to the lack of regeneration. Different tubes will change the results.

SPAGHETTI

(2041) Mr. H. M. Stoner, York, Pa., wants to know:

Q. 1. What are the mechanical and electrical features of good spaghetti tubing?

A. 1. Good spaghetti tubing will withstand 5,000 to 10,000 volts. It is flexible and will resist the action of gas, oil, acid, water and ozone. It has high tensile strength and does not harden or crack.

Q. 2. What is a simple test of good spaghetti tubing?

A. 2. When tied into a tight knot, it is easily untied; it will not crack and the inside channel remains open. It should not be possible to tear it crosswise.

Q. 3. Is it advisable to rewire a set having spaghetti-covered connections?

A. 3. If spaghetti-covered wires at different potentials are not run too closely together, undesirable condenser effects should not be produced, making rewiring unnecessary. This insulation should only be used when there is a possibility of two wires touching.

DERESNADYNE

(2042) Mr. John W. Smith, New York City, wishes to know:

Q. 1. What would be the best method for reducing the number of controls on the Deresnadyne receiver from three to two?

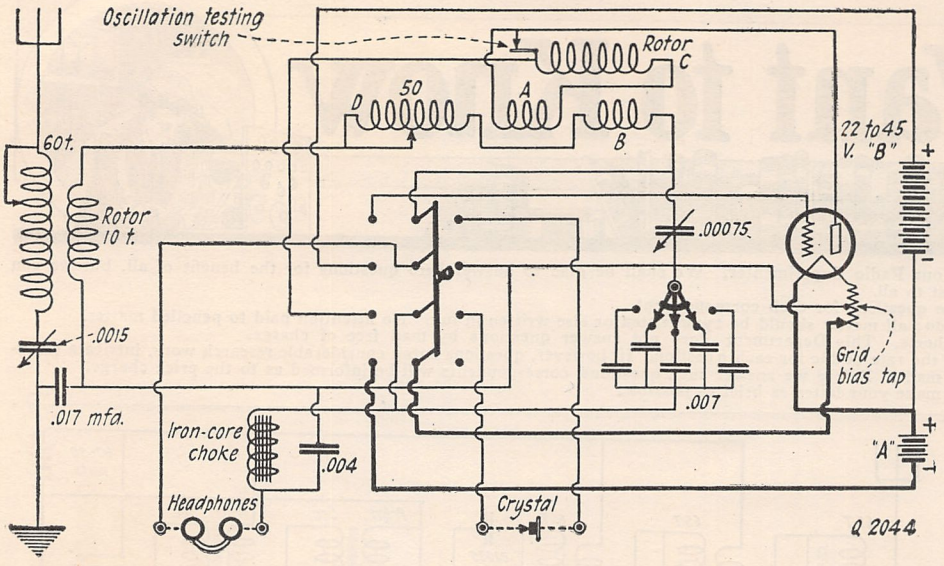
A. 1. We are showing the incorporation of the new variable condenser further described in the answers to question No. 2040, above. While the dial readings of the first condenser may vary from those of the remaining two condensers, the remaining two will have practically identical readings for a given adjustment, provided the coils are accurately constructed, as are most commercial coils of this type. Therefore, it is a simple matter to connect the dual-capacity condenser in the manner shown, eliminating one control. The wiring must be carefully done, so that the two grid wires do not couple unevenly to the other wiring of the set. Short leads are quite necessary. High efficiency apparatus is necessary for this circuit, since regeneration takes place to only a slight degree. A three inch tube may be used for the secondary, over which the primary is wound. This diagram illustrates the standard radio frequency circuit wherein amplification is had without a need for an extra oscillation control, since so few turns of wire are used in the plate circuits.

Q. 2. What is the form of winding called, in the instruments using D-shaped coils?

A. 2. This winding is referred to as astatic.

Q. 3. Do these coils produce a strong external field?

A. 3. The external field of these coils is unusually small.



The wiring diagram of the well-known Navy SE-1420 receiver, designed by the Bureau of Steam Engineering, is shown to be a complication of two simple circuits. Precision construction is necessary for satisfactory results with this circuit.

WIRE INSULATION

(2043) Mr. Charles Farrell, New York City, asks:

Q. 1. What is the thickness of silk and cotton used as wire insulation?

A. 1. This varies with the sizes of wire. The thickness is readily computed by using the figures found in tables of bare and insulated wire of the proper sizes.

Q. 2. What is the resistance of good enameled wire to the action of chemicals and heat?

A. 2. It is impervious to the action of ordinary solvents, alcohol (cold), mineral oils, weak acids, water and weak alkalis. Extreme heat has very little effect.

Q. 3. How can wire enamel be removed, without scraping the wire?

A. 3. The wire is first heated, then dipped into alcohol.

S. E. 1420 NAVY RECEIVER

(2044) Mr. Jerome Ellsworth, Phoenix, Arizona, inquiries:

Q. 1. What is the diagram of connections employed in the S. E. 1420 receiver?

A. 1. The diagram of connections is shown in these columns. To simplify the diagram, we have not shown the test buzzer connections. The crystal testing buzzer connects to a battery and push button, in the usual way. The vibrating member of this buzzer has a lead connected to it that winds around the aerial wire, inducing a small current in the set, for testing purposes. The panel is shielded, which shield is grounded. A fan switch controls the capacity of the .007 mfd. condenser. The two inductances tapped to contacts are controlled by switches that dead-ends the unused portions of the inductances. Note that no grid condenser or grid leak is used, the detector being operated at the lower bend of the detection curve, by reason of the negative bias of approximately three volts furnished by the two-ohm rheostat tap. The iron core choke coil may comprise 100 turns of 30 S.C.C. wire wound on an iron core one-quarter inch in diameter and one inch long. Coils A and B are stators, wound on the same three and one-half inch tube as coil D. The rotor, C, may be a tube or ball. A standard "split' variometer may be used for inductances A, B and C. A regular 43-plate variable condenser may be used in place of the one of .00115 mfd. capacity. The aerial tuning inductance (stator) and its accompanying rotor are placed in non-inductive relation to the other inductances.

Q. 2. How are tubes "matched" for use in the intermediate frequency amplifier unit of a set of the Super-Heterodyne type?

A. 2. One method for determining the general ability of vacuum tubes is as follows: Remove all tubes from the set except the detector tube and last intermediate radio frequency amplifier tube. Light both tubes and keep all values ("B" battery, rheostats, etc.) constant, with the exception of the potentiometer. Varying the potentiometer arm should result in the production of a rushing sound, or a click, at one position of the arm. This denotes oscillation of the tube. Three tubes that oscillate at exactly the same spot (position of the potentiometer arm) are to be used as intermediate frequency amplifier tubes. A tube that oscillates readily will make a good oscillator tube. Tubes that will not oscillate at all are not very good for any purpose. Should all the tubes be found not to oscillate, it is probably the fault of the set. Of course, such a possibility is not being considered in the above testing description. After these general characteristics of the tubes have been found, they may be placed in the set, in the positions determined desirable for them.

Q. 3. What are the general characteristics of the Marconi V-24 tube?

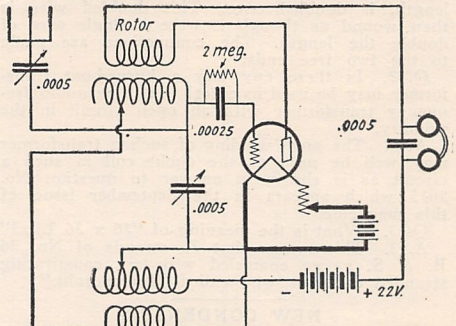
A. 3. This tube has an exceptionally low internal capacity. In order to reduce the capacity between leads, the leading-out wires are sealed at opposite sides of the tube. The filament wires connect to terminals placed at the far ends of the tube. The filament voltage is 5; amperage, .7; plate voltage, 24 to 60; plate-to-filament impedance, 16,500 ohms; amplification factor, 7.

THE "X" WIRE

(2045) Mr. Robert East, Niagara Falls, N. Y., inquires:

Q. 1. What is Hazeltine's "X" wire?

A. 1. The "X" wire has been variously termed a "——dead end wire simply laid along the bottom, or low potential end of the neutroformers, one end being connected to the first neutroformer.



Exceptional range has, in some instances, been claimed for the double regenerator. Standard variocouplers are used. Rotor plates of grid circuit variable condenser should connect to filament.

This seems to create a tendency for the set to oscillate at high wave-lengths and not at low, thus serving to equalize the degree of oscillation;" "—is employed in a set—that is subject to oscillation, due to improper shielding—and is connected between the grid of the last tube and the ground;" "This wire (the 'X' wire) is—the one used for over-all neutralization." This latter is the true explanation. After the tube and most of the other capacities have been neutralized, there sometimes remains a capacity between the input and output radio frequency circuits. The over-all neutralization scheme is applied in the following manner. The Neutrodyne remains connected in the usual manner, with these exceptions. The aerial, instead of being connected to a coil that is separate from the grid tuning coil, is connected to the grid tuning coil directly; not to the grid or filament, but to a tap on the tuning inductance, across which inductance the tuning variable condenser is connected in the usual manner. This tap may be at about eight turns from the filament end of the coil. A neutrodon is now connected from the detector side of the last neutrodon, to the filament end of the aerial (and therefore the first grid) tuning inductance, through a single turn of wire.

Q. 2. What is the exactly correct angle for neutroformers?

A. 2. Theoretically, the exact axial angle for neutroformers inclined from a common center line, is 54.7. This was determined mathematically. Practically, it is necessary to vary slightly from this figure, in most cases, due to variations in equipment and wiring.

Q. 3. Should a phone condenser be used in a Neutrodyne receiver?

A. 3. A phone condenser of .001 mfd. capacity is required in a Neutrodyne receiver, but it is not connected across the transformer primary, as in regenerative circuits. One side of the phone condenser connects to the plate and the other side of the condenser must connect directly to the filament negative.

DOUBLE REGENERATOR

(2046) Mr. Nelson Haas, North Plainfield, N. J., wishes to know:

Q. 1. What is the diagram of connections known as the "double regenerator?"

A. 1. The diagram is shown in these columns. Condenser arrowheads indicate the rotor plates.

Q. 2. What special equipment is required?

A. 2. Nothing special is required. Regular variocouplers may be used for both sets of coupled inductances.

Q. 3. What points should be observed in its adjustment?

A. 3. The grid leak should be varied for best results, at the same time that the "B" battery voltage and filament battery voltage are regulated. While adjusting for maximum results, the tuning controls should be repeatedly adjusted in an effort to increase the strength of weak signals. Adjustments should only be made on weak signals. The adjustments would be different, for strong stations, in order to receive these stations very loudly, but most people desire as great a range as is possible with their sets. For very best results, a UV-200 tube will be found best. True, one ampere is required for the filament, but greater range will result from the use of this tube. Other tubes may be used with quite excellent results.

LONG WAVE QRM

(2047) Mr. Grant H. Waldron, Decorah, Iowa, writes:

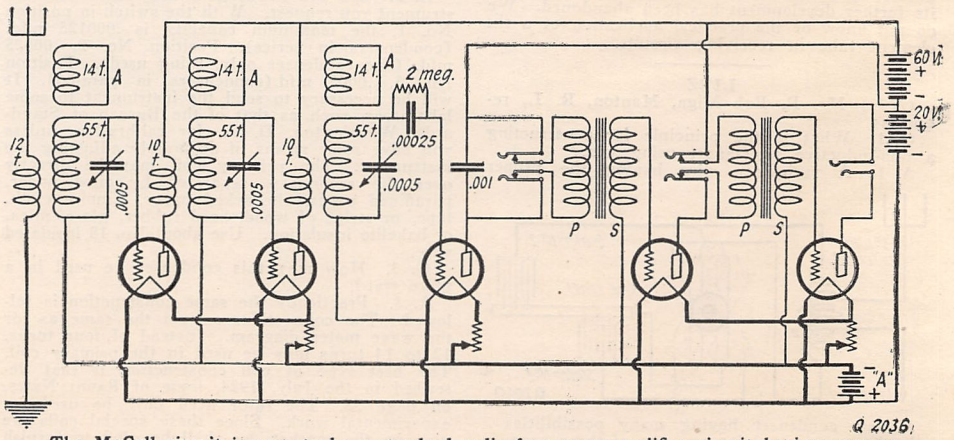
Q. 1. Is the insulating value of cotton and silk changed when colored?

A. 1. Unbleached cotton and natural silk have the highest insulation value.

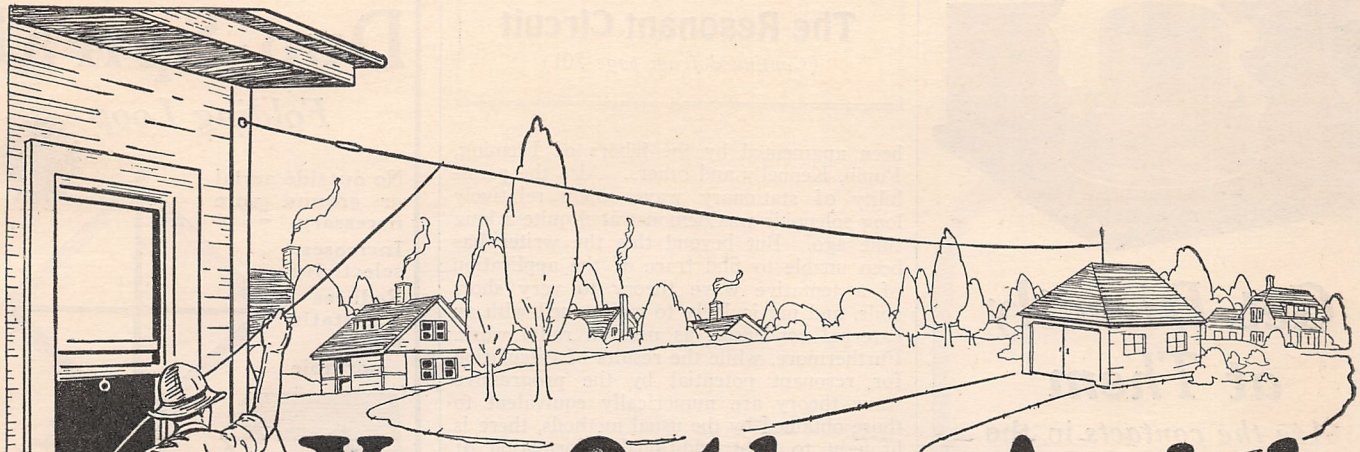
Q. 2. How can the intermediate radio frequency amplifier unit of a Super-Heterodyne be prevented from picking up code signals from long wave sending stations?

A. 2. It will be necessary to change the transformers and oscillator coil to a different band of long wave-lengths, or else to completely shield the amplifier unit. A seamless metal case is best.

(Continued on page 796)



The McCall circuit is seen to be a standard radio frequency amplifier circuit having regeneration control in the form of an absorption coil. This eliminates the usual potentiometer, with its attendant losses, by maintaining a negative bias.



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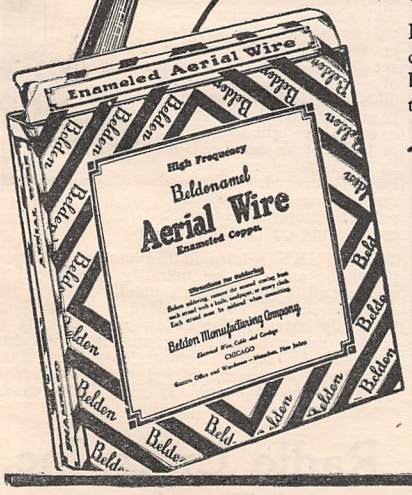

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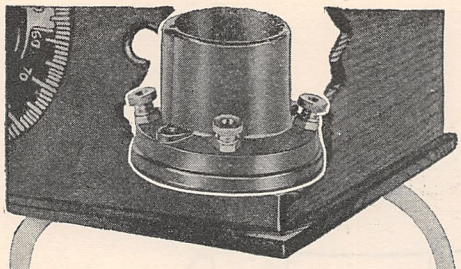

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Just rotate the tube three or four times. Instantly the dual-wipe laminated contacts remove corrosion, making a bright perfect connection. This action is on the side of the tube terminals away from the soldered ends. *"It's the contact that counts."*

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ALDEN MANUFACTURING CO.
Dept. K SPRINGFIELD, MASS.

The Resonant Circuit

(*Continued from page* 701)

been augmented by the labors of Fleming, Pupin, Kennelly and others. Also the possibility of stationary waves upon relatively long solenoids was demonstrated quite a long time ago. But beyond this the writer has been unable to find trace of the application of a tentative wave theory to very short coils, and particularly to coils tuned with an external condenser, as used in radio work. Furthermore, while the results of calculation for resonant potential by the progressive wave theory are numerically equivalent to those obtained by the usual methods, there is brought to light additional information of such nature that, if previously uncovered, it would doubtless be in circulation today.

Of the fitness of this application, the writer, after its mathematical development and months of patient observation, is convinced beyond reason to doubt. The fact alone that the calculated wave-length upon a coil at natural period equals twice the length of the coil is taken as evidence conclusive. Again, there are everyday phenomena which point the same way. One of these, and at the same time a phenomenon which doubtless has been observed by every user of the regenerative receiver, is the heterodyning of a carrier wave to an audible whistle, while the signal itself is too faint to tune in. Another is the superior sensitivity to code and C.W. over phone signals, in both instances longer wave trains being the key to explanation.

The foregoing explanations, therefore, apply to the coil as well as to the conductor, and constitute the theory of resonance at natural period. No external condenser is used. The resonant potential is highest when the potential is impressed at the exact middle; also, as compared with the tuned coil, the coil at natural period has the highest resonant voltage and the broadest tuning.

CONDENSER IN CIRCUIT

Now suppose the coil is bridged with a condenser, as illustrated in Fig. 6. The potential gradient along the coil is increased, due to increased current, and the coil reacts to the wave as if it were longer than it really is. Thus it may be tuned to longer wave-lengths.

In explanation an analogy with water waves will again be resorted to. Imagine a trough of water, Fig. 7, in which a dasher, A, churns up and down at constant speed. Since for a given amplitude of the dasher the velocity of wave travel will be constant, for resonance the length of the trough must be such that a wave will travel from the middle to the end and return in half of one cycle or period of the dasher. Then at the ends the water will pile higher and fall lower with each succeeding oscillation of the dasher, which situation is resonance at natural period.

Suppose now, still using the same length of trough, it is desired to slow up the speed of the dasher (corresponding with an increase of wave-length). The wave then

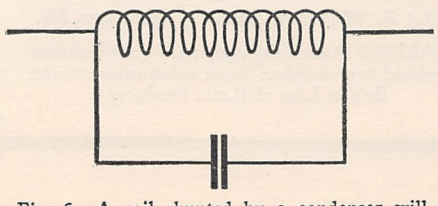
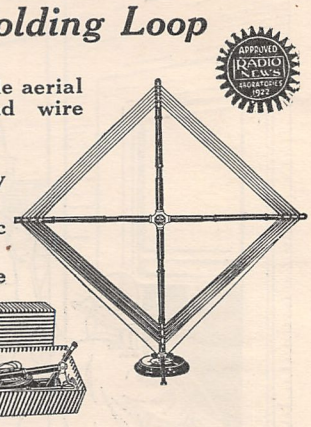


Fig. 6. A coil shunted by a condenser will respond to a wave-length, higher than its fundamental.

Duo-Spiral

Folding Loop



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Tiny-Turn

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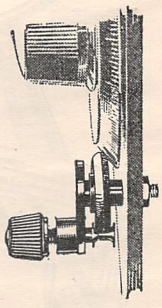

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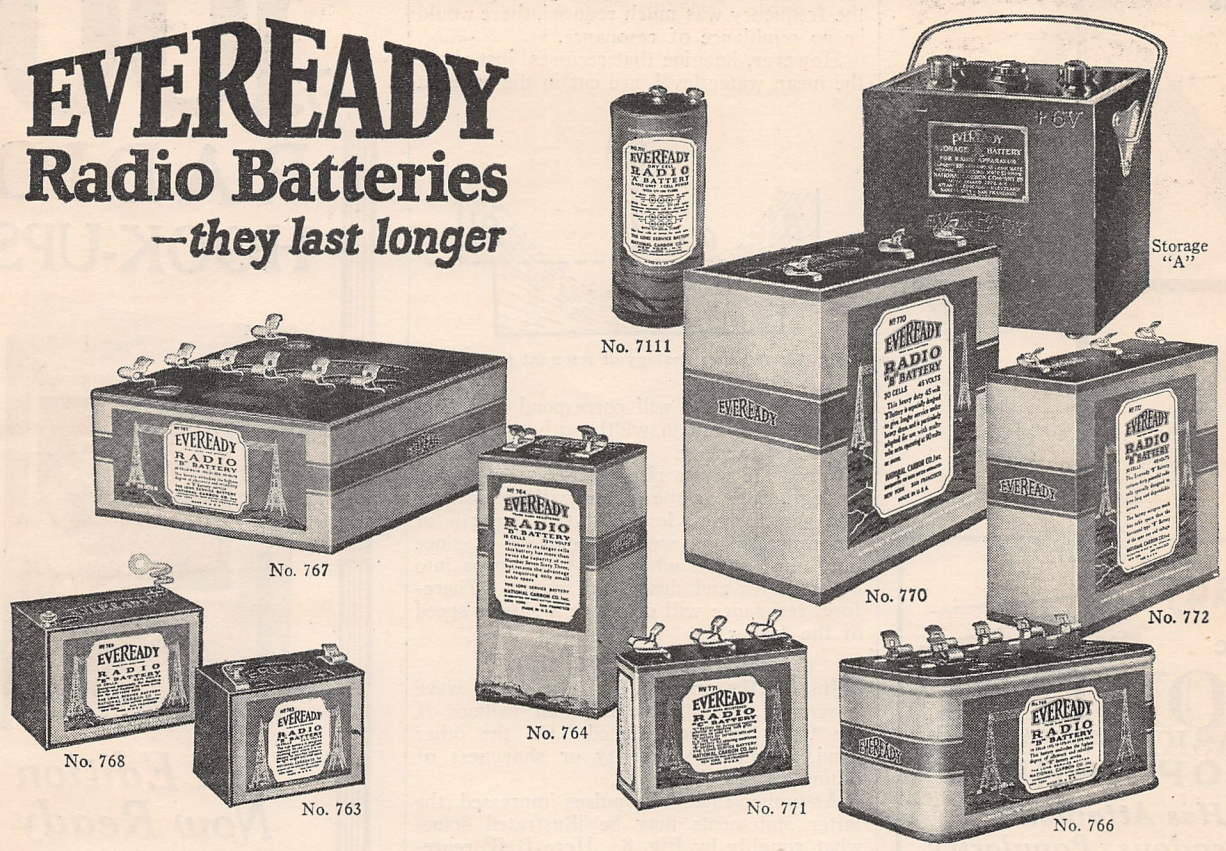

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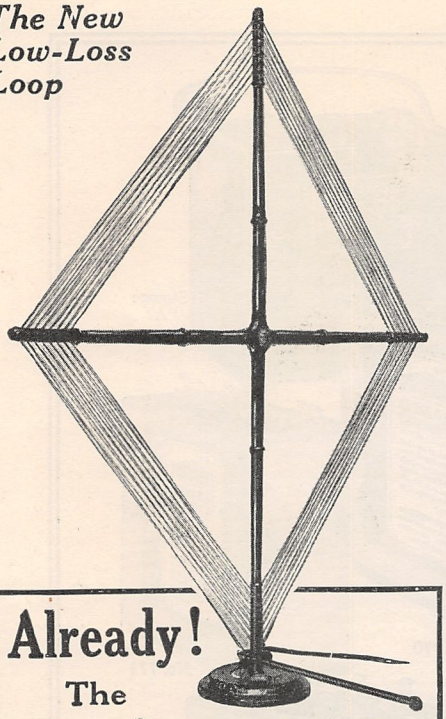

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would have more than enough time to travel to the end and return a half period, and if the frequency was much reduced, there would be no semblance of resonance.

However, imagine that recesses, just above the mean water level, are cut in the walls at

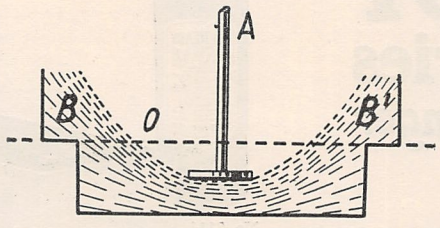

Fig. 7. A water analogy of resonant potential.

B and B^1. These will correspond with tuning capacity, and in width with the amount of tuning capacity.

When the waves rise, instead of mounting so high, part of the water will break over into the recesses, lessening the strength of the reflection, as well as delaying it, since time must elapse while the water runs into the recesses and drains out again. Therefore, resonance will obtain at a slower speed of the dasher.

SELECTIVITY GAINED

Just as the amplitude of the water wave is reduced, so will the terminal voltage of the tuned coil be reduced. On the other hand, however, selectivity or sharpness of tuning will be improved.

Assuming sine wave pulses impressed, the latter statements may be illustrated somewhat roughly by Fig. 8. Here B B^1 represents the actual coil length, A A^1 the virtual length due to external capacity, this virtual length corresponding with that of a coil the natural period of which would be that to which the real coil is tuned. At natural period, therefore, the terminal resonant voltage would be proportional to twice 0 A or 0 A^1. On the real coil, however, it is proportional to twice 0 B or 0 B^1.

If the coil is tuned to a still longer wavelength the lines O Z and O Z^1 move in the direction of the arrows toward the perpendicular. The position of these lines determines both terminal voltage and selectivity, the latter not apparent from the figure. One increases as the other decreases, one according to the trigonometric cosine of the angle Z0A, the other according to the tangent. Above 45 degrees slight changes in this angle cause increasing differences in the value of the tangent, and from this point on selectivity improves faster than the signal strength decreases. For signal strength, therefore, there should be large inductance and small capacity, and the reverse for selectivity.

Properly speaking, resistance has no rela-

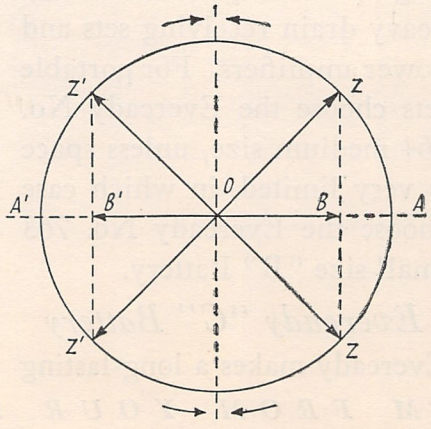

Fig. 8. A schematic representation of the effects produced by shifting the values of inductance and capacity.

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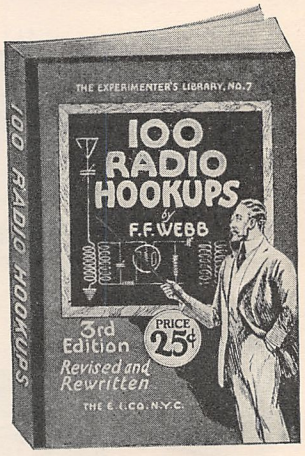

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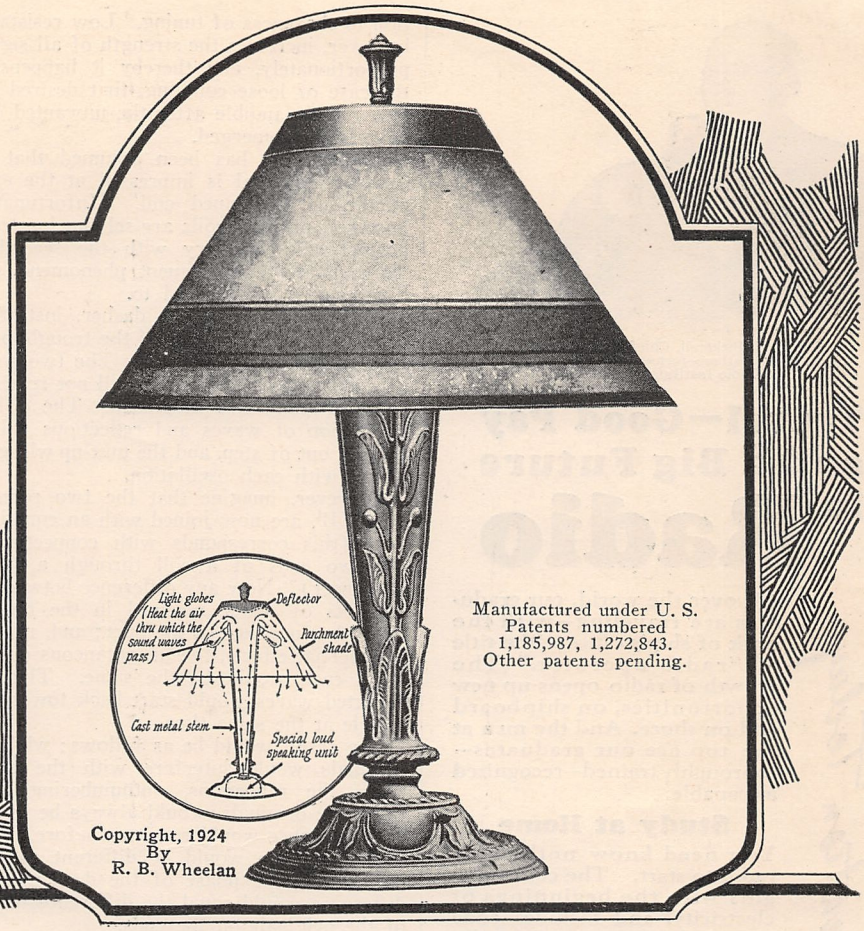

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Simply attach the light cord of the Radialamp to any socket and switch on the light. The result is a soft, restful, mellow glow. Then attach the Radialamp to your receiving set — just as you would attach head phones. Instantly the room is flooded with music — amazingly clear, flawlessly natural—the most perfect tone reproduction known. **No extra batteries are required—no adjustments to make.**

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tion to sharpness of tuning. Low resistance, however, increases the strength of all signals proportionately, and thereby it happens, in the case of loose coupling, that desired signals remain audible after the unwanted ones have been submerged.

Thus far it has been assumed that the exciting potential is impressed at the exact middle of the tuned coil. Unfortunately, however, primary coils are seldom located in geometrical symmetry with the secondary. To explain the consequent phenomena, Fig. 7 will again be referred to.

Suppose first that the dasher, instead of oscillating at the middle of the trough, oscillates at some other point 0. The two waves of displacement, therefore, will not reach the corresponding ends in unison. The orderly procession of waves and reflections will be thrown out of step, and the mix-up will grow worse with each oscillation.

However, imagine that the two recesses, B and B^1, are now joined with an equalizing duct (this corresponds with connection of the two ends of a coil through a tuning condenser). Now any difference between the amounts of water received in the recesses would be equalized in the duct; and, neglecting inertial effects, the instantaneous outflow from each would be the same. Thus the reflected waves would start back toward the middle at the same time.

The result would be as follows: while the originals would interfere with the reflections, the reflections, outnumbering many times the originals, would always be in step, and resonance would result as before, except that the phase would be different as compared with the phase of the dasher. This difference would equal the difference in time of the originals on the ends.

In similar fashion resonance results on a tuned coil when the primary is placed in a symmetrical relation to the secondary winding. Theoretically, though not practically, a 90 degree shift in the phase of the secondary terminal voltages is possible. Since the sum of two forces is the greatest when they act in the same line, the foregoing bears upon the operation of both Regenerative and Super-Heterodyne receivers, and in this connection application for patent, under the title "synchro-coupler," was made by the writer some months ago.

MODULATED WAVES

The logarithmic law of resonant amplitudes, it will be recalled, applied only to unmodulated wave trains—namely to those of even amplitude. In broadcast and phone signals we are interested in modulated trains, either of sine formation, or at least of an order that can be resolved into sine formations. The latter, since any series of wave shapes, however irregular so long as they are repeated at regular intervals, can always be resolved into sine harmonics. In Fig. 9 one such sine formation, corresponding say with the single beat of a tuning fork, is illustrated at ABC.

To explain what happens to such a train on a resonant coil the analogy of the pendulum will again be chosen. This time, instead of receiving uniform thrusts, the pendulum will be acted upon by forces of

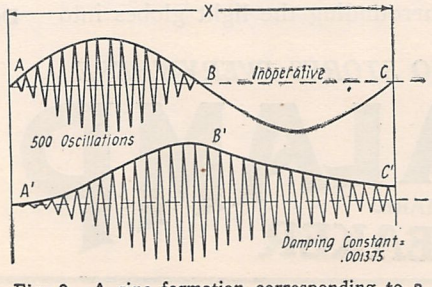

Fig. 9. A sine formation corresponding to a single beat of a tuning fork.

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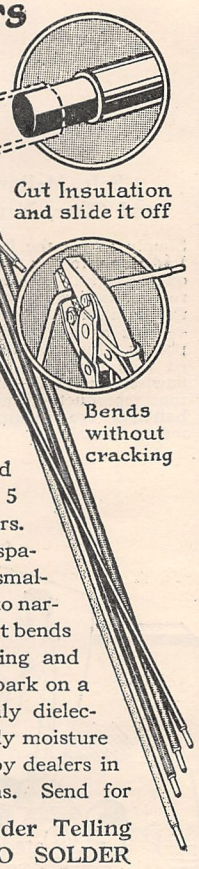

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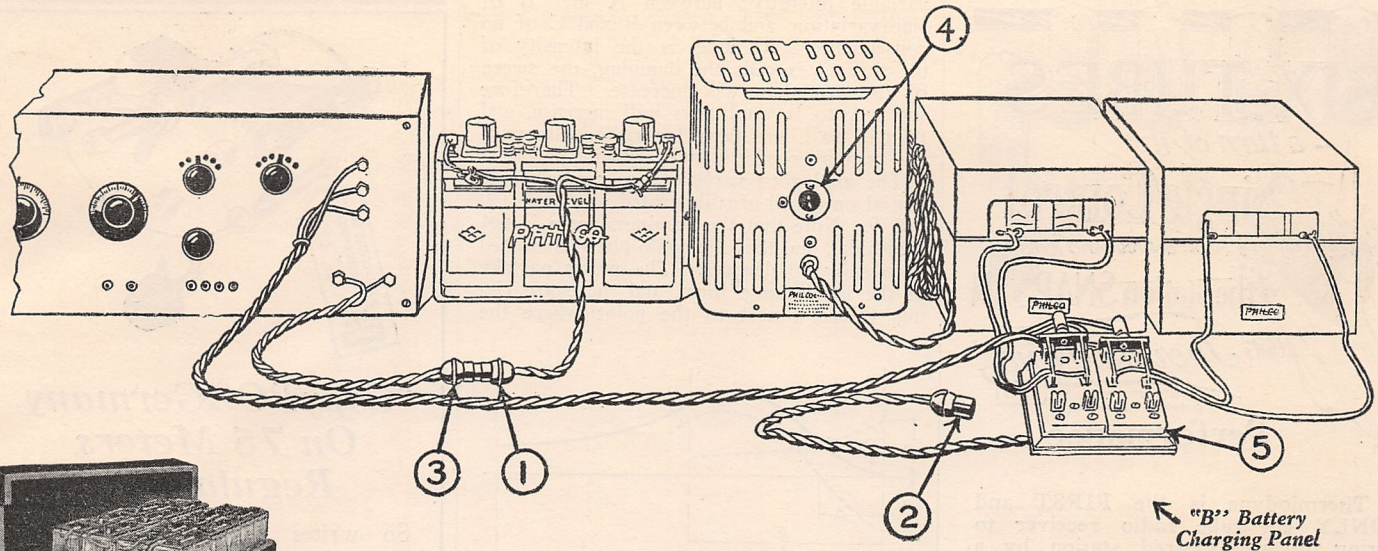

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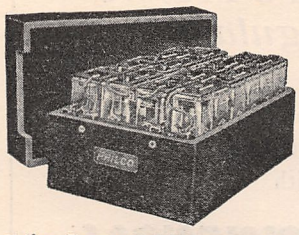

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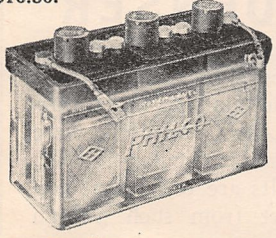

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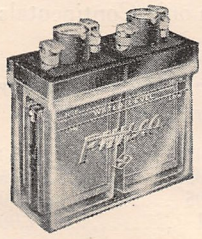

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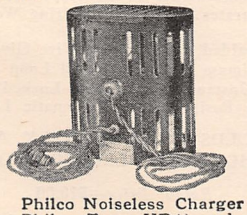

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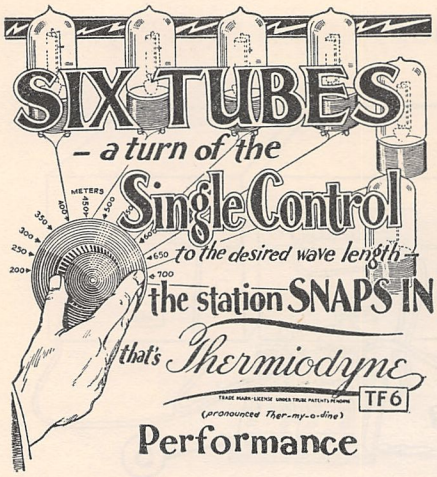

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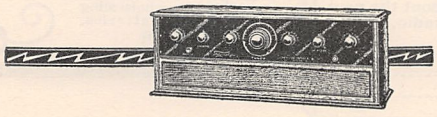


variable intensity; between A and B of sine variation, and between B and C of no consequence. As long as the intensity of the thrusts exceeds the damping, the sweep of the pendulum will increase. Therefore from A to B amplitudes will increase, and from B to C die away logarithmically until the beginning of the next cycle.

The analogous variations of resonant potential on a coil are illustrated at A^1 B^1 C^1, Fig. 9. Note that the resultant form is not sinusoidal, and that the audio phase is shifted practically 90 degrees. The wings partake of the logarithmic form, and there are rising values almost to the point where the

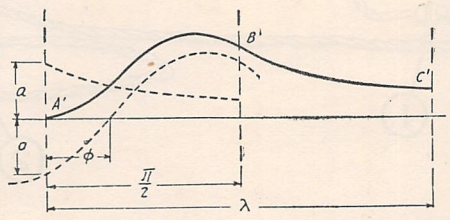


Fig. 10. Illustrating the analogous variations of resonant potential on a coil.

impressed oscillations cease. From B^1 to C^1, the conventionally inoperative period, the curve falls away as the accumulated oscillations decay logarithmically in proportion to the damping.

Fig. 10 shows the graphical construction. The full line from A^1 to B^1 is the sum of a logarithmic curve and a displaced sine curve, and from B^1 to C^1 it is a simple logarithmic curve.

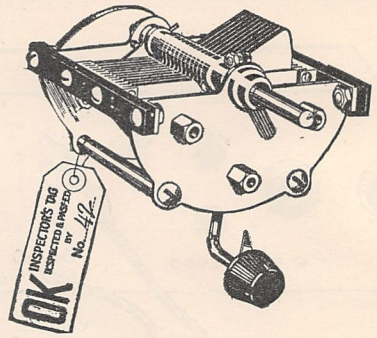
Obviously if the damping were zero the built up oscillations would continue unabated and there would be no variation of signals on the grid. At the other extreme, if the damping were infinite or exceeded a certain amount there would be no resonance, and the curve would follow the sequence of the impressed oscillations. Thus a certain amount of damping is necessary, damping of grid and grid leak, of course, operating in conjunction with coil damping, in which connection a nicely adjusted grid leak probably does more than bias the grid. Damping affects the shape of the curve A^1 B^1 C^1 by operating directly upon the angle phi, thereby varying the position of the dotted sine curve.

Neglecting the complex effects of damping, the highest amplitude attained is roughly proportional to the total number of oscillations per train. This means that higher harmonics, consisting of shorter wave trains, tend to drop out. This and the fact that the wave form itself becomes altered are two of the numerous causes for distortion before the ear of the broadcast listener is finally reached. At the transmitting end also, since the wave goes out on a resonant circuit, these distortions occur.

Consideration of the foregoing principles will explain also the inefficiency of the Super-Heterodyne first detector. In the first place, since amplitudes reached are as the length of the wave train, breaking the train into fragments results in a serious loss of amplitude. In the second place, the heterodyned wave train differs greatly in form from that of the modulated carrier. The so-called inoperative period, BC Fig. 9 is missing, and the decay of the built up oscillations, corresponding with the wing B^1 C^1 must occur in the beat period. The merits of such receivers as the Ultradyne and Second Harmonic are due largely to the fact that these disadvantages are compensated.

While the damping increases with the increase of inductance, nevertheless it can be shown that for all combinations resonant potential will increase as the natural wavelength is approached. Obviously, therefore,

(*Continued on page* 724)



"Copy POZ Germany On 75 Meters Regularly!"

So writes a government radio official who is doing much short wave research work using circuits equipped with

CONTINENTAL LO LOSS CONDENSER

Small wonder that we receive enthusiastic reports of great distance efficiency, and clarity, for *Continental* Lo Loss Condensers were built for that particular service, and the results are only what you should expect from such a high grade instrument.

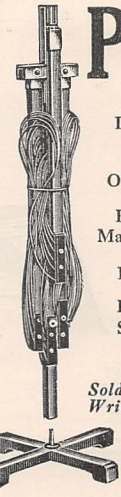
If you have passed the "novice" stage of reception only Continentals will satisfy you.

Write to us if your dealer can only offer something "just as good"

13	Plate,	Cap.	.00025	$5.50
18	"	"	.00035	5.75
25	"	"	.0005	6.00
45	"	"	.001	7.00

Price without vernier $1.00 less

GARDINER & HEPBURN, INC.
Sales Office, 611 Widener Bldg., Philadelphia
Factory, 2100 Washington Ave., Philadelphia



POLLARD LOOP

Distance and Clarity of Reception
Elimination of Interference
Convenience in Transportation
Operates on all Broadcasting Wave Lengths
Braided Pure Copper Wire Gives Maximum Efficiency on all Loop Sets
Instantly Opened and Locked In Position with Automatic Latch

FOLDS CONVENIENTLY AS SHOWN IN ILLUSTRATION

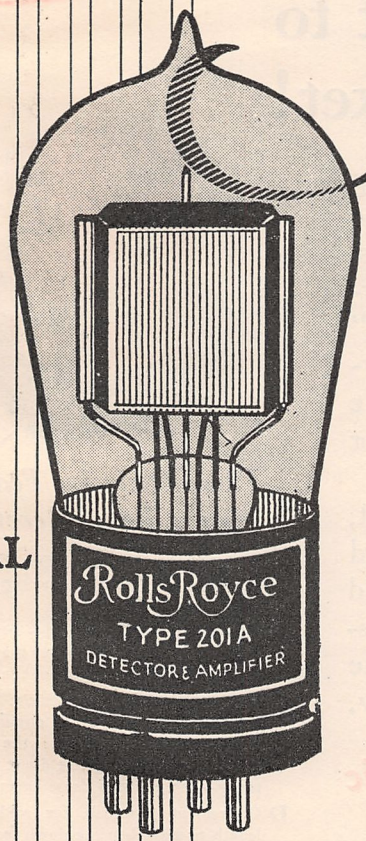
Retail Price—$10.00

Sold to the trade through regular jobbers
Write for complete, illustrated circular.

POLLARD BROS. MFG. CO.
4036 N. Tripp Ave., Chicago, Ill.

"the Rolls-Royce of Radio Tubes"

Rolls Royce
RADIO TUBES



ACTUAL SIZE

$2.50

Like their name, significant of quality. Durable and powerful. Bring in distance with a maximum of volume and clearness.

Rolls Royce Tubes Now On Sale

Type 200—5 volts, .1 ampere $2.50
Detector Tubes

Type 201A—5 volts, .25 amperes $2.50
Amplifier and Detector

Type 199—3-4 volts, .06 amperes $2.50
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Type 199A—Same as 199 ..... $2.50
with Standard Base

Type 12—1½ volts, .25 amperes $2.50
Platinum Filament—Amplifier and Detector

Type 202—7.5 volts, 2.35 amperes, 5 watt oscillator..... $3.00

Every Tube Guaranteed

To work in Radio Frequency, especially adapted for Neutrodyne, Reflex and Super-Heterodyne Sets. The moderate price of this tube will enable you to keep an extra one or two on hand in case of emergency. Send in your order today. We guarantee immediate shipment and all tubes are packed in special sealed cartons.

Tubes Shipped Parcel Post C. O. D.

ROLLS-ROYCE TUBE CO.,
21 Norwood St., Newark, N. J.
Gentlemen:
Kindly ship parcel post C. O. D. the following tubes .....
..... to
Name .....
Street Address .....
City or Town .....
State .....

Dealers and Distributors

Our liberal proposition will be interesting to you now that the big radio boom is in full swing. Write at once.

Rolls-Royce Tube Co.

21 Norwood St., Newark, N. J.

Ask Any Radio Engineer What to Look for When You Buy a Socket!

Radio experts are continually stressing the necessity of using good sockets. In some of the more sensitive circuits such as the Superhetrodyne, poor sockets often completely destroy results. In fact, in thousands of sets today, with scores of different circuits, the so called "static" often mentioned, or "battery noises," are in reality merely the result of poor socket contacts—certain proof of dissipation of the feeble currents that we rely on for distant reception.

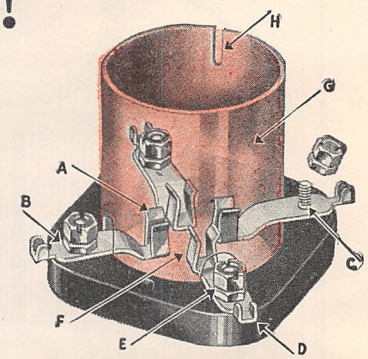
Minimum Dielectric Capacity

In the Cutler-Hammer Socket, designed by the same engineers whose precision rheostats and other radio current control apparatus have justly become world famous, every effort has been bent toward greatest efficiency. Custom has no consideration—and from its striking color scheme to its novel contact construction, the design is radically new.

It embodies a minimum of both insulation and metal; capacity absolutely minimized without sacrifice of mechanical strength. The insulation materials (shell of thin orange Bakelite and base of genuine Thermoplax) are ideal—high in quality and dielectric strength; low in dielectric capacity and losses. And all metal parts are widely separated, both in the insulation and in air to conserve every last bit of energy received.

Maximum Dielectric Resistance

Its contacts—the source of losses and noise in most sockets—are of entirely new construction. Each one is a springy clip



These Exclusive Features Assure Better Reception

A Perfect contact. Both sides of tube prong cleaned when inserted—no contact or wear on soldered end.

B All metal parts *silver* plated—perfect contact for the life of the set. Silver may tarnish but its contact resistance does not change.

C One piece contact construction. The binding post is NOT a part of the circuit—the wire to the socket always touches the contact strip which carries the current direct to the tube prong—no joints to cause losses.

D Convenient terminals for soldering—full length to allow bending down for under-wiring. Ears hold wire in place for soldering.

E Extra handy binding posts—tight connections with either wrench or screw-driver. Lock washers hold terminals rigid.

F Wide spacing of current carrying parts both in air and insulation—true low-loss construction.

G A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

H The tube is held in place by merely a vertical motion—no twisting to separate bulb from base.

"*Built by the*

C-H

The Perfect

that clinches the tube prong without strain; yet cleans it bright whenever the tube is inserted or removed. These contacts are formed of phosphor bronze and *silver* plated—because the contact resistance of silver does not increase as it stands exposed to air. The area of contact is greater than that found in any other socket; and the construction is such that these feeble currents which mean so much in radio pass directly from the wire to the prong of the tube without meeting a single joint. *(In so many sockets the wiring is attached to a binding post to which the contact strip is in turn attached below. This presents a joint which causes noise and losses. The* C-H *Socket affords perfect connection even if the screw that holds the contact strip in place is entirely removed.)*

Silver Plated Phosphor Bronze Contacts

No Joints to Cause Noise or Losses

In this socket the tube is inserted and removed without turning—just pushed in and pulled out—to prevent twisting the bulb from its base. And the tube is held tight, absolutely rigid so that any vibration cannot cause contact noises. Its small size and convenient soldering terminals, too, mean a great deal in most sets for space is usually at a premium. The Thermoplax base is only 2⅛" square—scarcely more than the diameter of the tube, and the soldering terminals extend out far enough from the rounded corners that they may be turned down for under-wiring when this system is used. These terminals have handy ears which are bent up to hold the wire while the solder is being applied—adding much to the ease with which this work is accomplished. For temporary connection, or where soldering is not used, a slotted hex-nut is provided which securely clamps the wire against the contact spring with either wrench or screw-driver.

Convenient and Efficient Terminals

No Twisting to Damage Tube

In all it is as perfect a socket as engineering skill can devise. It offers maximum efficiency and ease of installation, coupled with an appearance that adds much to any set. And best of all you will like the price, 90c. *This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today!* If your dealer has not been stocked, you can be supplied direct from the factory at list price plus 10c for packing and postage.

THE CUTLER-HAMMER MFG. CO.

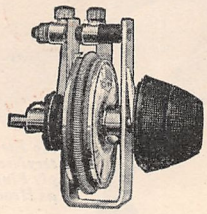
Member Radio Section, Associated Manufacturers of Electrical Supplies

MILWAUKEE, WISCONSIN

Master Builder"

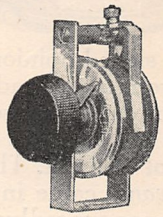
C-H

Instruments of Guaranteed Quality Assure Success in Radio



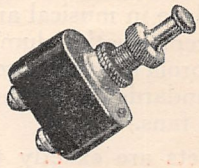
The C-H 4 Ohm Vernier Rheostat

Perfect detector tube control. Also furnished without vernier for amplifier tube control.



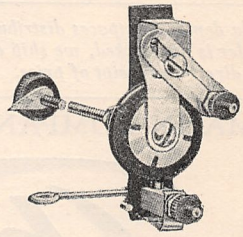
The C-H 30 Ohm Radio Rheostat

For control of the ¼ ampere, "UV201-A-C301-A" type receiving tubes and the "UV199-C299" type; also made in 125 ohm size.



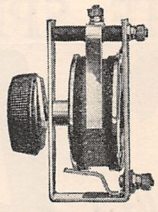
The C-H Radio Switch

The switch with the perfect mechanism for providing easy control of the most delicate circuit without introducing microphonic noises—one hole mounting.



The C-H Variable Grid Leak

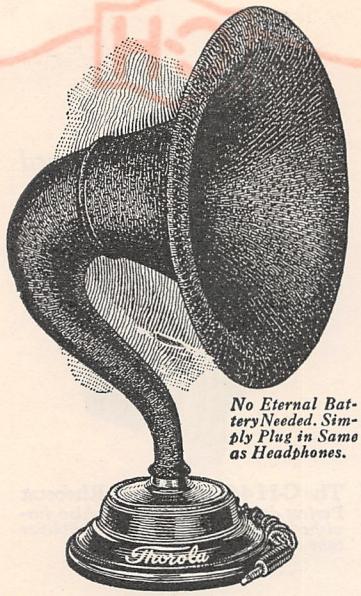
Mounted on the tube socket-panel controlled. Adjustable for all grid condensers.



The C-H Radio Potentiometer

The potentiometer with the resistance unit that does not wear and cannot be displaced under constant use.

RADIO SOCKET



No Eternal Battery Needed. Simply Plug in Same as Headphones.

"I have been fortunate enough to dispose of all the loud speakers I had on hand before I received the Thorola, for I would never have been able to do so, had I demonstrated the Thorola."

SCORES of signed opinions like this come in from smart radio dealers. They know the public pulse. Nothing in radio, they tell you, has caused the profound stir of Thorola. Thousands of dollars *in advance* came in to reserve Thorolas when announced by the makers of the celebrated Thorophone.

Thorola, perhaps more than any other single factor, now lifts radio to an undisputed place in musical art. Thorola fidelity of reproduction dumfounds the critics. Thorola advance over previous highest standards elates the most sophisticated fans.

Costliest sets are exactly the opportunity Thorola seeks, to demonstrate beyond question what vast improvement now is made possible. Whatever circuit or power you use, Thorola will lead you to new radio enjoyment.

You will bring in weak signals clear and strong, so efficient is Thorola. You will have so much volume ordinarily that clarity need never be sacrificed.

You will discover volume, tone quality, sharpness of speech, delicate shading, response to control, made possible only by Thorola betterments — the acoustically perfect horn of Thorite compound — the Permanent Adjustment for precise synchronization with your set — the Controlled Mica Diaphragm — the Amplifying Lever and other advancements.

But you must convince *yourself* of all this superiority. Thorola must live up to every claim or the Thorodealer refunds your money. Thorola thrives under this guarantee. See your Thorodealer.

Thorola demand outpaces distribution. If your dealer is not stocked, we ship any model direct on receipt of price.

THOROLA 4, $25 — THOROLA 3, $20
THOROPHONE *Powerplus Speaker* $45
THOROLA 6, *Phonograph Attachment* . . . $15
THOROLA 9, *Cabinet Loud Speaker* $40

REICHMANN COMPANY, 1729-35 West 74th Street, CHICAGO

Thorola

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Loft Inc. CANDY!

Fresh by Mail

Delicious, pure sweets direct to you from LOFT'S big sun-lit kitchens in New York City. Prices unbelievably low. Highest standard of quality backed up by our 50 year reputation. Send for our free candy catalog. Over two hundred varieties of these famous candies to suit your taste and purse!

FREE CATALOG LOFT, 400 Broome Street, Dept. 108, New York

N&K Imported Phon Unit

Clear, rich, mellow tone. Attaches instantly, without screws, to any standard phonograph. $7.50 at leading radio stores. Write for folder.

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UNITED ELECTRIC STORES CO

East Pittsburgh, Pa. — Next door to KDKA

Wholesale Radio Equipment

Same Day Shipments

the highest inductance consistent with the required degree of selectivity should be chosen, and efforts devoted to reduce its damping.

THE CURVES

Consider a single-layer helix of length A and diameter B, and closely wound with wire of diameter d. In these three dimensions all the factors of the damping constant times and attenuation distance may be expressed, and the result is

$$(1) \qquad u = \frac{K\ L\ c\ 1/2}{B^2\ k\ 3/2}$$

in which L is the inductance chosen, c the unit distributed capacity, K a constant, and k a variable factor used in calculating inductance. The latter is dependent upon the ratio of diameter to length of the helix.

The foregoing, it should be noted, shows that the damping can be reduced most of all by increasing the diameter B, since the damping decreases as the square of this.

In Fig. 11 three curves are drawn to illustrate the variation of c with windings of different diameters. The other curves are calculated for windings of 4 inch diameter. The next curve shows how the damping increases with the ratio B/A; namely as the coil is shortened by winding with finer wire, the total inductance to remain the same.

In general, however, flux linkings between primary and secondary will increase as the coil is shortened, and so a curve proportional to flux linkings is drawn also. Induced voltage is proportional to flux linkings, and so in a round about manner is signal strength. The flux curve, combined with the curve of damping, shows a relative signal strength practically uniform over a wide range irrespective of the ratio B/A. Moreover, with higher damping, the curves of potential growth and decline are steeper, and for this reason short coils may be more efficient than long ones.

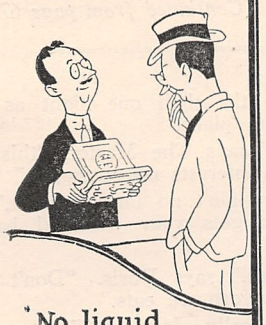
Since distributed capacity is dependent upon an integral sum of reciprocal distances between one point in the winding and every other point two facts are evident; that the capacity between adjacent turns, separated only by the insulation of the wire itself, constitutes but a small portion of the whole; second, that in compact windings of the bank and spider-web classes the distributed capacity is necessarily greater than that of the corresponding single-layer windings.

Why these classes of windings are more efficient can best be explained by example. Imagine a close wound helix of length A and diameter and wound with wire of the size which gives the desired inductance. Now if the size of the wire is doubled, making the coil twice as long, the efficiency, as the curves show, remains practically the same, and little is gained. But on the other hand, instead of changing the proportions of the coil, suppose the wire is doubled in size, and a bank winding, basket weave or other form is adopted, which allows the same number of turns as before to be laid in the same axial winding space. Then a real gain will have been made, even if the distributed capacity is twice what it was before. The unit inductance will be the same, the unit capacity, say twice, but the unit resistance one fourth. Therefore we will have gained by the ratio $\frac{\sqrt{2}}{4} = 0.34$, and the damping constant will be approximately one third of its former value.

MAKE IT SNAP-PY

RADIO FAN: "I have tried 20 different hook-ups on my radio."

RAY D. O.: "Why don't you try buttons and save time?"—*Leslie Carpenter.*



"No liquid in it now ~

Dear Jim:

I saw a new stunt pulled yesterday.

Happened to be standing side of a chap who was buying some storage batteries for his radio set when the salesman turned one of them upside down.

What do you think? It was bone dry—not a drop of solution in it.

"There's the battery for you—and it's specially built to do a radio job," he said. "It is one of those new Willards—charged but bone dry and it is ready to use as soon as it is filled. Lasts you longer, because its term of life doesn't start until it is filled."

That's a real idea Jim—starting the life of the battery after the owner buys it; but I don't think you can wear out Willards anyhow. Mine are four years old now, and they are as good as the day I got them.

Willards for economy and clear reception.

Signing off

• • • • — — — —

(SAM)

Now it's a live battery"

WILLARD RADIO BATTERIES

Write to WTAM *for these two booklets*

[The Voice of the Storage Battery]

WTAM is the Radio Research Laboratory and Broadcasting Station of the Willard Storage Battery Company, Cleveland, Ohio.

Write for WTAM'S booklets, "Better Results from Radio" and "The Proper Use and Care of Radio Storage Batteries." They will be mailed to you with our compliments.

Tear me off the page and mail me to WTAM. I'll bring you "Better Results" and "Proper Use and Care."

Name .....

City and State .....

Street Address R.N.-2

No antenna —Just the Ducon

No more need to labor and toil over erecting an aerial. No more need to worry about the appearance of a bulky indoor loop in your home. The Ducon saves your time —and solves your problem.

Screw the Ducon into any accessible electric light socket and when you want to hear a program just tune in.

The Ducon brings in the stations clearly. The fact that over 400,000 fans use it is convincing proof.

Try it. You can purchase a Ducon on a five-day trial basis from your radio dealer.

The Ducon sells for **$1.50** *in all reliable stores.*

Dubilier

CONDENSER AND RADIO CORPORATION

24 Pages — OUR NEW CATALOGUE — 2400 Items

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Is the most complete list of **Radio Sets and Parts** ever published and contains prices on material for building all the latest circuits such as

Super-Heterodyne - Teledyne
Ultradyne - Cockaday Superdyne
Neutrodyne
Harkness Reflex
Erla Reflex

and many others.

It also contains prices on many "hard to get" special parts such as

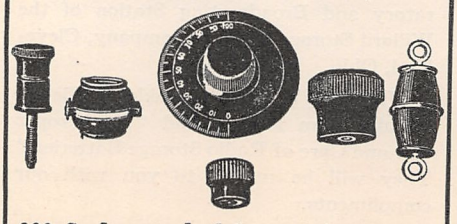
Litz Wire, Screws, Brass Rod, Tools, Engraving Rotors, Washers, Hex Nuts, Phosphor Bronze Wire, Choke Coils, Lavite Resistances, Pig Tail Wire and hundreds of other important items.

Send 10c and we will send you one of these Catalogs. 10c refunded first purchase.

SIMPLEX RADIO SALES CO.
1804 Lafayette Ave., St. Louis, Mo.

"INSULATE"

(Molded Composition)
Registered Trademark
Also
"HI-HEET" (Bakelite)



200 Styles stocked for quick delivery.

GENERAL INSULATE CO.
1025 Atlantic Ave. Brooklyn, N. Y.
Established 1904

Cent from Heaven

(*Continued from page 672*)

through the shell one night as we lands from the 'plane.

"Joe," says The Master, "this theatrical business interests me strangely."

"There ain't no interest in it," I states. "If you gets your principal back you're lucky."

"Rotten," says Doris. "Don't try to be funny before we eats."

"But really, Joe, I'd like to go on the stage."

Doris and me both does the exclamation act.

"You wanta go on the stage?" I repeats.

"Yes."

"But what could you do?" demands Doris.

"Act," says Jerry, soulfully.

It's plain The Master is plumb serious about it.

"You wanta go on the stage—you, with plenty of money, lots of things to do, and a comfy home?"

"I do."

"But why?" demands Doris, who also ain't so bright under certain conditions.

"I believe I could do something worthwhile," declares The Master. Then he turns to me. "Joe, would it be in keeping with the principle of vaudeville to stage a scientific act?"

I'm recovered by this time and seeing as how The Master is really foolish, I talks sense. "My boy," I states, "anything the people'll pay to see is O. K. in vaudeville. But you mean, has it ever been done before?"

"That's it," agrees Jerry.

"Well, it has," I informs, "but if you could give it a few new twists—"

"I had intended to," puts in The Master eagerly. "While radio is to most people very common, I shall give demonstrations of unfamiliar uses to which it can be put, such as radio transmission of power, sending pictures by radio, radio control of remote devices, and so on. Would it appeal, do you think?"

Personally, I has grave doubts, but after twenty years in the show business I've learned to recognize the symptoms of stage stroke, and this case is past the discouraging point. You just gotta let it run its course.

"Well," "I says, "you'd have to dress up your act a lot, and of course run in a good deal of comedy to hold the walkers, because it's marks to pretzels you'll be spotted closing."

This he don't mind in the least, and his confidence is so beautiful I ain't got the heart to spoil it. I figures I can get Jerry on the big-time and tie him up on the same route with us, so I can keep an eye on him and maybe step in on his act and clown a bit to stay the subway chasers. At any rate, The Master brought it on himself, and can afford it, and it ain't none of my business, so I says let him have his fling.

Seeing our act in rehearsal has utterly spoiled The Master. He figures he's gotta go us one better, and the painful part is, he does!

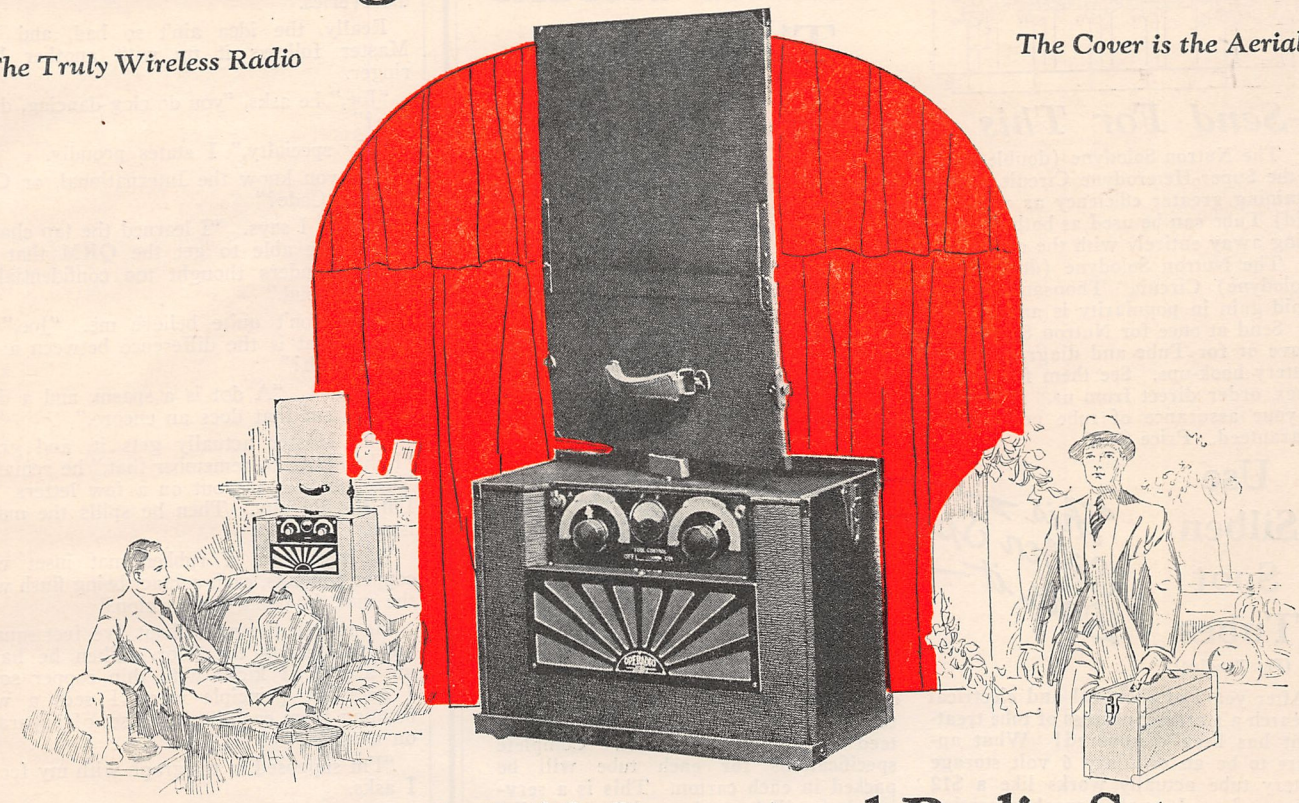
Money being no object, he opens his purse strings high, wide and handsome. And he also has an idea! Not that ideas is at all scarce with Jerry, except that they is usually confined to such as crossing a loud speaker with a marriage license in order to create a wife that can be shut up.

"I shall," he says, "call my act 'The

Presenting The 1925 Operadio

The Truly Wireless Radio

The Cover is the Aerial



The Original Self-Contained Radio Set

With many revolutionary improvements and a new application of the Cascade Radio Frequency Circuit (capacity compensated)

The 1925 Operadio develops still further the unique Operadio idea—a radical departure in radio design.

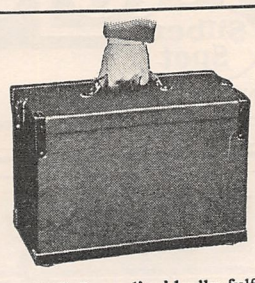
Operadio engineers set for themselves this task—to produce a radio set of the highest efficiency, to give it beauty worthy of any surroundings, to do away with the need of external wires or connections and to design it in so compact a form that it can be easily carried anywhere.

Introduced last year, the Operadio created a country-wide sensation. Many thousands are now in use. In the new model all the former features are retained—the loud speaker, six tubes, dry cells and all parts are fitted into a compact cabinet and the necessity for aerial and ground is eliminated by a patented wave-bridge located in the cover. To these are added new refinements and no less revolutionary improvements.

The 1925 Operadio is marked by extreme beauty of appearance and efficiency of performance. The wave band is expanded to include reception from radiocast stations of all wave lengths. Utmost simplicity of tuning—only two controls. Razor-sharp selectivity.

The remarkable efficiency of the set is due to the perfected application of cascaded radio frequency amplification, capacity compensated. For example, the set contains removable radio and audio units. In each of these are hermetically sealed all the finely adjusted parts in perfect and unchanging balance, thereby insuring absolute uniformity of performance and virtually eliminating the possibility of damage.

There are many additional exclusive features—a specially designed condenser with planetary disc vernier control, safety fuse for tubes, "A" and "B" battery tester, space for largest size "B" batteries, etc. Write at once for particulars.



The 1925 Operadio ideally fulfills every need for an easily-operated, reliable, long range home set—complete and ready for instant operation and easily taken with you anywhere.

The Operadio Corporation, 8 South Dearborn Street, Chicago

Dealers: Write on your letterhead for our sales proposition and full particulars about the 1925 Operadio.

OPERADIO

MAIL THIS COUPON

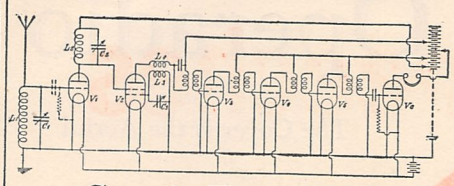
The Operadio Corp.,
8 So. Dearborn St., Chicago, Ill.

Please mail me complete particulars about the 1925 Operadio.

Name .....

Street .....

City ..... State .....



Greater Results Than Ever!

—*Send For This Diagram*

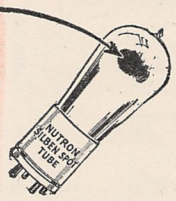
The Nutron Solodyne (double-grid) Tube acts as both oscillator and modulator in the Super-Heterodyne Circuit, thereby not only eliminating one of the tubes but obtaining greater efficiency as well. In Reflex Sets the Nutron Solodyne (double-grid) Tube can be used as both detector and amplifier (dual amplification), thereby doing away entirely with the crystal or detector tube.

The Nutron Solodyne (double-grid) Tube made possible the No "B" Battery (Solodyne) Circuit. Thousands are now enjoying this smooth reception and its rapid gain in popularity is ample proof of its unusual qualities.

Send at once for Nutron Solodyne (double-grid) Tube and diagram illustrated above or for Tube and diagram of 2-tube reflex circuit, or for Tube and No "B" Battery hook-ups. See them for yourself. If your dealer does not yet carry these tubes, order direct from us. Always look for the Silben Spot (Pat. Pending). It is your assurance of tube perfection. Each Nutron Tube is rigidly tested and guaranteed. Price $6.00.

Use Silben Spot Tubes
(Pat. Pending)

This Silben Spot Does it—



Nutron Matched Tubes Silben Spot
(Pat. Pending)

After years of chemical and electrical research a startling process of tube treatment has been discovered! What appears to be an ordinary 6 volt storage battery tube actually works like a $12 power tube. It makes weak reception strong and good reception stronger.

The "Rendement"

Ordinary tubes have three measurements. The Silben Spot Tube 1A has a fourth, known as the "rendement." The secret is in the Silben Spot (Pat. Pending). Furthermore, every Silben Spot Tube is DEPENDABLE because each one is rigidly tested before it leaves our factory. Each Silben Spot Tube gives known results. Price $4.

Mr. Set Manufacturer: You can now guarantee every one of your sets working perfectly on tube operation. Our Service Department will match tubes for your particular set, pack them in cartons of three or six, as required, each tube individually marked and guaranteed correct for your set. Complete specifications for each tube will be packed in each carton. This is a service that will be welcomed by your distributors, dealers and customers. Nutron Matched Tubes—matched to your set requirements—identified and improved further with the Silben Spot (Pat. Pending)—tested and guaranteed—can be made available to your customers if you say so.

A Real Service

We can accommodate a few reliable set manufacturers with this service and furnish Nutron Matched Tubes in sufficient quantities to meet all their requirements. Mr. Set Manufacturer, this represents tube insurance to you. Write, wire or phone for consultation.

NOTE

We recommend to owners of Super-Heterodyne and reflex sets the use of Nutron Matched Tubes in conjunction with the Nutron Solodyne (double-grid) Tube — The Silben Spot (Pat. Pending) on all these tubes is your guarantee of perfect satisfaction with your set. Nutron Matched Tubes: Set of 3, $12.00; set of 6, $24.00; Nutron Solodyne (double-grid) Tube $6.00.

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Silben Spot

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Your dealer will tell you why Marle Transformers do not howl or distort. Uniform amplification up to as many as 3,500 cycles.

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Experimenter Publishing Co., 53 Park Place, N. Y. C.

Wizard of Mars.' The setting will be my own conception of possible life on that planet, and I myself shall don a costume in keeping with our most recent astronomical discoveries."

Really, the idea ain't so bad, and The Master follows it up with another bell-ringer.

"Joe," he asks, "you do clog dancing, don't you?"

"My specialty," I states proudly.

"Do you know the International, or Continental Code?"

"Sure," I says. "I learned the tap chatter just to be able to get the QRM that the brass pounders thought too confidential to talk out loud."

Jerry don't quite believe me. "Joe," he asks, "what is the difference between a dot and a dash?"

I smiles. "A dot is a spasm, and a dash is a spasm that does an encore."

The Master actually gets it, and grins. "I shall have to remember that," he remarks. Then he tries me out on a few letters, but I'm the fly guy. Then he spills the major issue.

"I have here a rubber mat inset with copper contacts, each contact being flush with the mat, in polka-dot fashion."

He unrolls the mat, about five feet square, and puts it on the floor. Then he hands me a pair of kicks with thin copper soles. I gets the principle when I sees a wire running from each heel to a set of apparatus on a table.

"I'm supposed to telegraph with my feet?" I asks.

"That is just what I have in mind. Could you do it?"

I tries, but makes a terrible mess of it, the system necessarily being altogether different from ordinary clogging. But pretty soon I begins to get the knack of it. When I wants to stay silent, I steps on the heel; when I transmits, I steps on the sole. It's a great scheme.

"I shall advertise this novelty and attract the radio amateurs," says Jerry, being a business man even if it ain't necessary. "I shall give away a prize of two tickets to next week's show to the amateur who turns in the best copy of what you send."

It's clever, and I don't deny it.

Well, for the next week we rehearses steady. I gets so I can send anything, and The Master is convinced that future radio transmission will be done by the feet. Then Jerry's scenery arrives.

I've been in this show game ever since I was big enough for the old folks to drag on during the bows, but I ain't never seen any stage setting that equals The Master's. I can't describe it, but combine all the chop suey houses, DeMille bathrooms and cubist paintings you ever saw and you'll have a remote idea of what his outfit looks like. It's full stage, of course, with a lot of nickeled apparatus. One look at it tells me if anyone walks out on that flash they're either blind or newly-weds. But Jerry's costume—Oi!

The men of Mars, says The Master, need big lungs, on account of the air being thin up there, they having no Congressional investigations. So he has a chest on him that looks like a couple of 1914 audions. His ears are nine times too large. Also, he has a trunk extension for his nose. But it's a wow get-up, and if the gallery gods stays with us, Jerry'll survive, at least in part. Also, he has added to his act a couple of nifty dolls that Mister Ziegfeld overlooked, and regretted. They does a double dance with music coming to them through a coupla headsets designed like Kig Tut used to wear. The Master has a trace of showmanship in him somewheres, but he solemnly swears

Hear Presidential Speeches

1000 Miles Away on—

Radiotrola Baby Grand

A highly efficient radio frequency receiver designed to receive broadcast from local and distant stations, clear, loud, without distortion within a radius of one thousand miles.

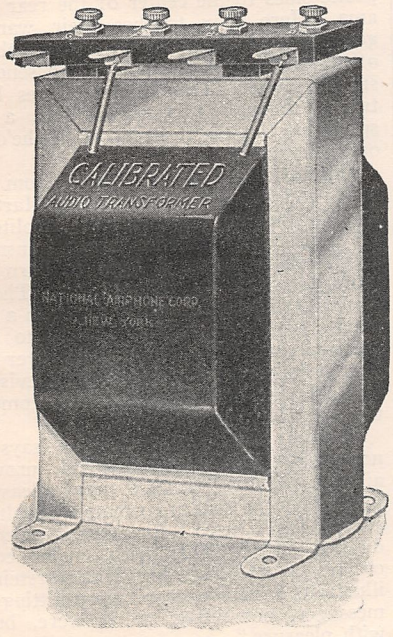
The MONODYNE Model GT-1, used by tens of thousands the world over with the highest satisfaction, has been further improved in the latest model, the "BABY GRAND." This model is enclosed in a beautiful cabinet, provided with individual compartments for tubes, batteries and headphones.

The cabinet is substantially constructed of wood and covered with Leatherette. A hinged cover with snap lock protects the entire outfit from dust. All connections are wired,—ready for batteries, aerial and ground.

The RADIOTROLA "BABY GRAND" has only One Tuning Knob. Stations always come in at the same point on the dial. It is equipped with a new Volume Control permitting fine adjustment on long distance reception.

Size 7⅛x7¼x11¼. Weight about 4 lbs.

Price $18.50 without tube, batteries or phones.



Price $7.00

New Calibrated Audio TRANSFORMER

Here is a transformer that not only positively eliminates all the draw-backs of other makes, but in addition stands head and shoulders above any other audio frequency transformer on the market today. To prove this seemingly flowery language, note the following:

From recent tests conducted in the RADIO NEWS LABORATORIES this transformer was found to have the following characteristics: The voltage amplification curve, obtained by applying a constant peak voltage across the primary in series with a 10,000 ohm resistance and measuring the secondary peak voltage at various audio frequencies without absorbing any current from the secondary, was found to be exceptionally flat throughout the entire band of audio frequencies. Tests were made at frequencies ranging from 150 to 6000 cycles, and the curve extended well into the lower frequencies where other transformers fail. In fact the amplification at 200 cycles was almost equal to the amplification at 1200 cycles, a condition not found in any other high grade transformer. The curve is flat from 1200 to 6000 cycles, giving a direct voltage amplification of from 4½ to 5 times throughout the entire range. Thus there is virtually no distortion caused by the transformer.

Tests made on the transformer in actual operation corroborated our electrical tests. Broadcast music was not only amplified and reproduced with life-like faithfulness but the volume was greater than that obtained from other transformers. The transformers had no tendency to oscillate at audio frequency, or squeal, as many do, and consequently require no shunt fixed condensers or resistances. Of particular notice was the volume and quality of the base notes of the saxophone, piano, etc. These notes, although missing in most receivers, came through with astounding volume.

A Calibrated Transformer

A print showing the calibrated curve is included so the user can tell how to get best results.

The "Calibrated" Audio Transformer is specially designed for Radio Broadcast reception reproducing voice and music faithfully and with freedom from distortion. High amplification at all frequencies. A high grade transformer giving results heretofore unattainable. Superior in design and beautiful in appearance. Improved terminal mounting giving maximum separation of grid and plate and admitting connections being made with equal facility in any direction, thus insuring short leads.

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Please send prepaid ☐ Baby Grand ☐ Calibrated Transformer for which I will pay the postman, upon delivery, the advertised price.

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NEW MODEL "C"

HAMMARLUND CONDENSER

Low Loss Grounded Rotor

When this new Hammarlund Model "C" was tested by the Marcellus Hartley Research Laboratory at Columbia University, this is one of the things reported:

"The effective resistance at 850 kilocycles was within one-tenth of an ohm as small as that of a standard condenser of this laboratory THE LOSSES OF WHICH ARE NOT POSSIBLE TO BE DETERMINED, because there is no type of condenser in any laboratory to compare with it."

The New Model "C" Hammarlund Condenser is more than just a precision instrument. It is greatly superior electrically, and it is more rugged in mechanical construction than previous models.

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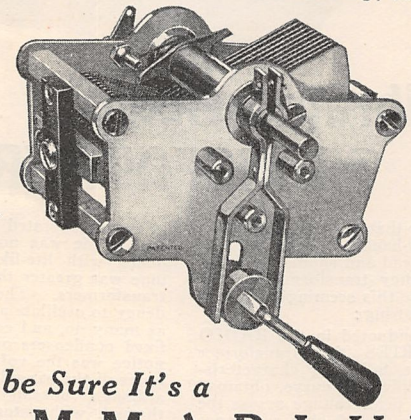

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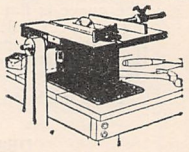

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that his only relative in the show game was a grand uncle that used to carry water for the elephants once a year back in South Bend, Indiana. Altogether, things looks fair to be set for the circuit as soon as we dogs it for a week or two.

We picks out two innocent Connecticut towns in which to work in our acts. Doris and me break in easy, but The Master don't fare none too well. His stuff requires one hour and twenty minutes, and knocking that hour offa his time requires more diplomacy than a King Kleagle at a meeting of the African Brotl rhood. Jerry doesn't like it very well.

"But Joe," says he, "my radio picture transmission is very elemental, and I can't get anything like a good picture across in less than an hour. It's so complicated."

"Fake it," I suggests.

"But that would be deceiving the public, and an insult to science," he declares. "I couldn't do it."

"Then cut it out entirely," I tells him. "You'll be playing to the Wood family if you trys to get an hour outa your stuff. It won't go."

Finally The Master consents to arranging it like I told him. He has two tables, a transmitter on one and the receiver on the other. He places a picture on a frame in the transmitter and the said picture is apparently wafted through the air and outa the other end. Of course it's faked, but the audience ain't wise, and that's all that matters.

After two weeks of try-outs we still has a split week ahead of us, so I wires into New York for metropolitan bookings. Meanwhile we plays New Haven and Hartford.

The Master's act is just enough different to make a hit with the Connecticutites. He opens full stage, all lights dark red. Then the two beefsteak crusaders comes on, each carrying a wand. They advances from opposite sides to the center of the rear cyclorama. Here they touches their wands together, which same ignites a spark that sets off a pan of flash powder, which sends up a smoke screen. The Master makes his entrance through this smoke into a green spotlight, the effect being as if he'd come outa the smoke.

His costume gets a big roar from everybody, and nobody having seen a Martian he don't attract no vegetables or impolite eggs. He immediately pulls his power transmission stunt, which causes a light to burn and a motor to run by radio-power. Then the Appetite Sisters does their dance to a strong hand. Back comes The Master to do his radio-picture stunt. This goes over better than we'd expected. After the television bit The Master comes to the big moment of the act. He makes a speech.

"Ladies and Gentlemen," he says, pronouncing every syllable, which proves he ain't a regular, "I take great pleasure in presenting the season's greatest novelty—the Radio Tap Dance. By means of contacts on this mat together with similar contacts on his shoes, Mr. Joe Hammerstein will illustrate a new way of transmitting radio messages, combining, as it were, business with pleasure."

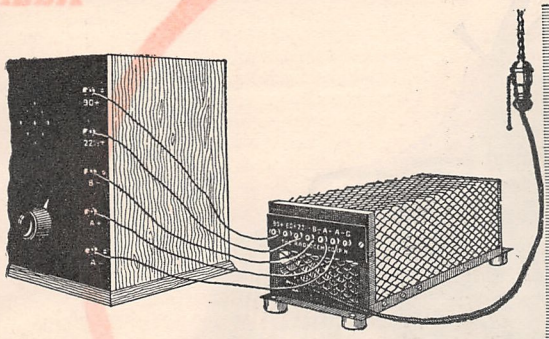
This last is as near as The Master can come to making a wise crack, but the bunch out front passes it up like a dawn-to-dusk flyer stops off at What Cheer, Iowa, for a cup of tea. But The Master speaks some more.

"As announced in the newspapers, the radio amateur submitting the best copy of what Mr. Hammerstein transmits will be awarded two tickets to next week's show."

There's a small flurry in the audience as pencils and paper are being arranged. Then I steps on and clicks off a part of a campaign speech I once heard a rural spellbinder lullaby to a crowd of cowboys out at Ocean-

(*Continued on page* 734)

NO MORE BATTERIES



A-B POWER UNIT

The New Radio Unit That attaches to any Radio Set replacing both A and B Batteries. Read These Facts

1—Absolutely eliminates all batteries.

2—NOISELESS at all times.

3—Will operate any set—no change whatsoever necessary in your set.

4—Steady current at full voltage always—a feature not found in batteries.

5—Will not overheat.

6—All connections identical to battery posts.

7—Will operate efficiently up to 10 tubes (¼ Amp. each).

8—Eliminates danger of burning out tubes.

9—Attaches to any Light Socket 110 Volt D. C.

PRICE $25.00

Sent Express Collect

Better order to-day. In two weeks' time we will be so swamped with orders that they will have to wait their turn. Orders sent now can be filled immediately.

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Gentlemen:—I enclose $25.00. Kindly ship me express collect one A-B Power Unit (for 110 volt D. C. current only).

Name .....

Address .....

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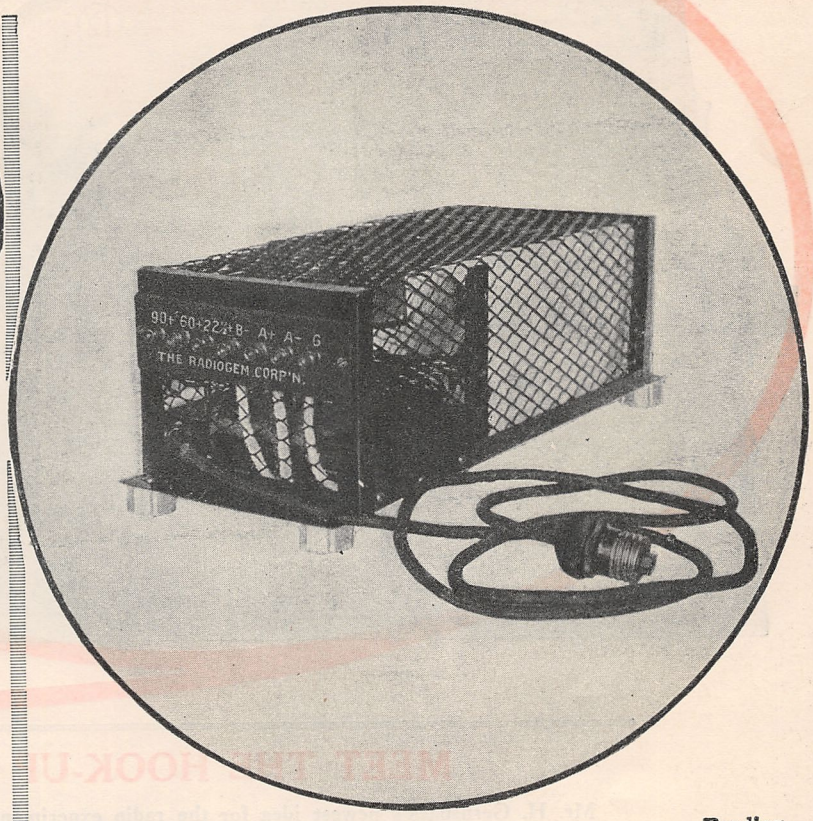

Patent Pending

AT LAST

The Logical Unit for Operating the Radio Set—Cleaner, Steadier, More Compact and More Economical than Batteries

You can dispose of your batteries. Both A and B types. You can use the large space they occupied for other and more valuable material. You can rid your radio set of the unsightliness of the A and B batteries.

We have just perfected this logical ideal unit for the operation of the modern radio receiving outfit, a unit that takes the place of your batteries and operates direct from 110 Volt D. C. house current from the nearest socket.

The unit is small, neat, compact, not messy. It is silent in operation, does not overheat and IT DELIVERS A STEADY CURRENT AT ALL TIMES FOR BOTH FILAMENT AND PLATE, THEREBY INCREASING THE SIMPLICITY OF OPERATION OF THE MULTI-TUBE SET.

It is easier to hook up than batteries, absolutely no change necessary in your set. All connections are identical to battery posts, and are so marked. Has taps for the following voltages: 6, 22, 60, 90.

Entire unit is only 14 inches long by 6 inches wide by 5 inches high. Construction is of the finest materials for dependable long life. The unit is beautifully finished and will not detract from the appearance of the most ornate receiving set.

This Unit for DC Current Only

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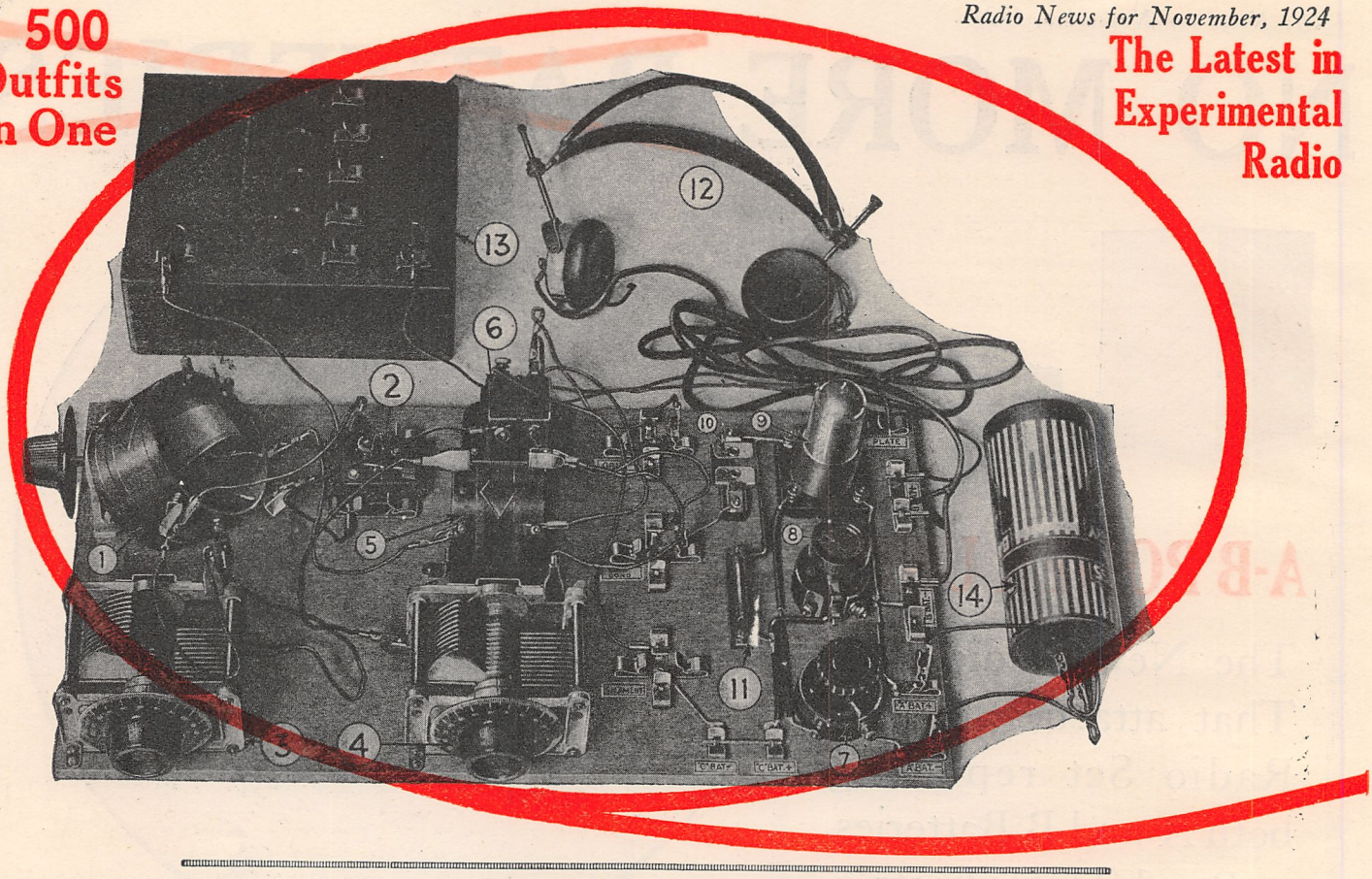

MEET THE HOOK-UP BOARD

Mr. H. Gernsback's newest idea for the radio experimenter. With this Hook-up board you can hook up any and every reflex circuit in existence, as well as many other circuits.

By means of the new CLIP LEADS and TIP LEADS, instantaneous connections can be made or broken. You will want to know all about it,—every little detail. The days of tedious connections by old fashioned wires and binding posts are past,—thanks to the Hook-up board.

Fully explained in the November issue of THE EXPERIMENTER.

The "Experimenter" Comes Back

WHEN the ELECTRICAL EXPERIMENTER started in 1913, wireless, as Radio was then called, was young. The ELECTRICAL EXPERIMENTER at that time was the foremost exponent of wireless, but wireless was in its infancy and did not have a large following. Electrical subjects, plus wireless, were not sufficient to build up a large circulation, hence the ELECTRICAL EXPERIMENTER in 1920 changed its name to SCIENCE & INVENTION.

In the meanwhile, about 1919, radio had become a big art, a separate magazine, now known as RADIO NEWS was found necessary, as it was impossible to do all of the radio subjects justice in a magazine covering every phase of scientific progress.

When PRACTICAL ELECTRICS was started three years ago, I had hoped that there would be enough readers interested in electrical subjects only, but this hope was not fulfilled. PRACTICAL ELECTRICS never published more than 60,000 copies.

During the past six years, I have been deluged with letters from admirers of the old ELECTRICAL EXPERIMENTER. Many of my former readers deplored the fact that the ELECTRICAL EXPERIMENTER was no more. I have given the matter very long and serious thought of late and decided to bring back the old ELECTRICAL EXPERIMENTER, not only as it was at its best, *but infinitely better.* That is why, beginning with the November issue, PRACTICAL ELECTRICS becomes THE EXPERIMENTER.

Those of you readers who remember the ELECTRICAL EXPERIMENTER, I know, will be delighted with the new magazine. There will be only three subjects, ELECTRICITY—RADIO—CHEMISTRY. 90% of the magazine will be devoted to experiments. The radio section, by the way, will be a brand new kind of radio, entitled *"Experimental Radio."*

There will be nothing but experiments written by the foremost writers. Here are a few of the radio experimental articles that appear in the November issue.

Little Known Methods of Producing Oscillations,
R. E. Lacault, A. M. I. R. E.
Single Tube Reflex Experiments.....Clyde J. Fitch
Converting the Single Circuit Tuner.....A. P. Peck
The Simpledyne Circuit.....Aurelio L. Fernandez
Radio Frequency Circuits.....W. L. Pearce
Single Control Receivers.....Marius Logan
Loop Aerial .....Elvin Tilton
Reaching Out with a Crystal Detector,
John Underhill House

There will also be a monthly editorial written by myself giving pointers on experimental work. Having been experimenting for some 20 years, it is my humble opinion that I am qualified to speak with authority on the subject.

The new EXPERIMENTER will be a huge improvement over the old PRACTICAL ELECTRICS: Better and more illustrations, more text, more pages. It has the sort of reading matter that every wide-awake experimenter craves for.

It also has a new eight-page roto-gravure section. In short, the magazine is *new* and better from start to finish. Look over your first copy, and I am sure it will convince you that the old EXPERIMENTER really has come back.

H. Gernsback

Editor.

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Resists the Most Rigid Tests

HEAT and weather changes, that play such havoc with rubber, are powerless to affect Spaulding Bakelite-Duresto panels which have never been known to warp, shrink nor split.

Highest in dielectric properties, and tensile strength, these panels saw, drill, engrave without chipping—retain indefinitely a beautiful mirror finish—all made possible by the special Spaulding process of fabrication.

Insist on Bakelite-Duresto, for the best that money can buy. Your dealer can furnish standard sizes from stock, individually packed in envelopes, special sizes to order. For a sign of quality apparatus, look for Spaulding Bakelite-Duresto panels in each set you buy.

Write nearest office for descriptive circular.

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This outfit is absolutely complete. Nothing more to buy—no batteries or tubes needed—no upkeep of any kind. The simplest radio outfit made—you assemble it yourself using only a scissor and screw driver. So simple that anyone can construct it. Complete instruction book with every outfit.

The Radiogem Corp. 66-R-W. B'way N. Y.C.

view, Wyoming. Then I disregards the code and gives a regular clog dance, except that I uses the click of a telegraph sounder in place of the usual heel tap. We closes to a fine hand and I sees where in front of a regular audience we're due to clean up.

Saturday night comes, and I don't get no wire from my agent until half way through The Master's turn. I smells several rodents the minute I sights the yellow envelope. I opens it and weeps. It reads:

HAVE BOOKED YOU IN POSITIONS REQUESTED TO OPEN MONDAY AT COLLOSUS.

To the ordinary laying man this ain't got no unhealthy significance. I'll explain. It means we're booked in order, namely, Intermission, then Hammerstein's Flips and Flops of This Season, then a monologuist, and then The Wizard of Mars. So far all right. But when I sees the house he's booked us into I nearly throw a fit.

The Collosus is a nice enough theatre, from an architectural standpoint. The parquet floor and balcony draws polite folks, but the Judgement Crowd sits up in the gallery, and as judges they're the bootlegger's license. Furthermore, they don't withhold no decisions. If you're good, and they likes you, they lets you hear it; if you're rotten, and they don't like you, they lets you feel it. The Collosus is one of the few first-class houses that still has an old-fashioned gallery gang and the bunch seems to know it. They'll heave anything from cabbages to kings but the Monday matinee crowd has a preference for pennies. If your act ain't no good you can always collect carfare from the birds on high.

For our own act I ain't wasting no worries, we being a standard act and a favorite at the Collosus for years. But The Master is a stranger in a foreign land. If he gets by and don't need no ambulance I'll be thankful.

Being a noble soul at heart I tries to make The Master understand what he's up against, but he don't savvy.

"Rude persons in the gallery throw missiles upon the stage?" he repeats, absent-minded like. "I shall not permit them to disconcert me."

That's that.

Monday a. m. we breezes into the Collosus for rehearsal. All goes as well as any rehearsal, which means the result was a cross between old home week at the insane asylum and the last game of a tie in the World's Series. But we pulls through not much the worse for swear.

Jerry's outfit gives the stage boys the time of their lives at the Monday matinee. The connections is apple pie to The Master, but to the stage hands they looks as simple as an income tax blank. Since most of the heavy power hooking has to be done in the few minutes just before the act goes on, Jerry is as busy as an old maid's tongue at a scandal party. But finally things is set and the front drop goes up on The Wizard of Mars. I stands in the wings ready to run and protect The Master if the deities on the top shelf ain't charitable.

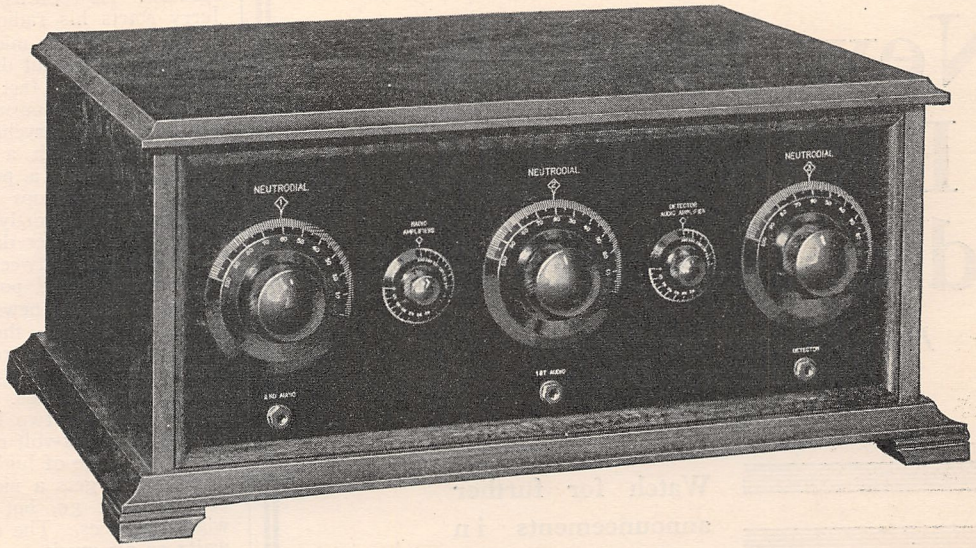
Of course, Jerry's set gets a lot of "oh's" and "ah's" from the audience, even a line or two coming down from the roof-tree roosters. The two chow mein addicts gets a lot of eyes as they crosses to the center of the cyclorama. I'm all set for any emergency.

The girls touches their wands together and the spark ignites the powder. When the smoke clears away, there is The Master.

For a second or two there ain't a sound. Then comes a chuckle or two. Then a laugh. Someone in the upper layer gets talkative.

"My Gawd, the zoo's loose!"

This, of course, starts a small riot, which ain't quieted none by the fact that the flash powder has left a black streak across The



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THE Adler-Royal Neutrodyne is the most advanced application of the neutrodyne principle to radio reception. It not only eliminates necessity for technical knowledge but its range and selectivity are remarkable even in the hands of those who know nothing about the fine points of radio.

Encased in beautiful cabinets with a finish like a grand piano, The Adler-Royal Neutrodyne will be an ornament to any home.

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Extreme Selectivity.—Due to the special type of condensers, losses are reduced to a minimum.

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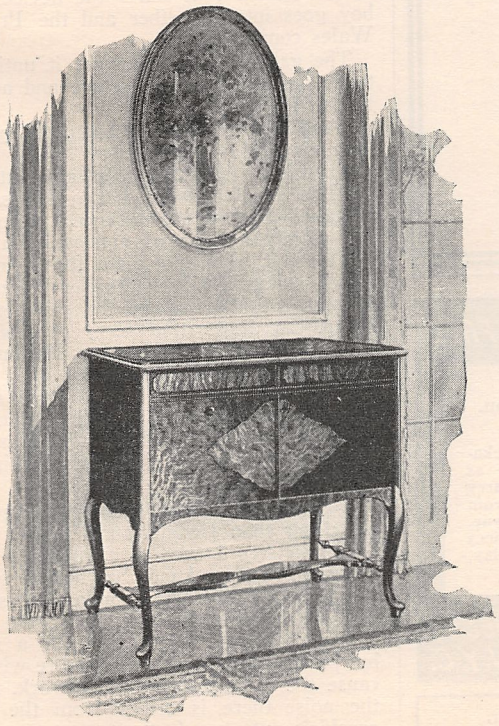

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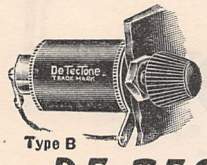

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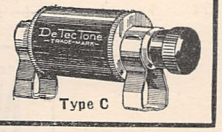

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Master's cheek. The high exalted rulers thinks it's a comedy act and gives it a jazz send-off. As soon as things is near normal Jerry starts his radio-power outfit.

Along about the middle of the demonstration some doughnut dunker in the jury box gets hep to the fact that The Master is serious. And seriousness for a novelty closing act is like strychnine to a yellow pup. Pretty soon, with a ring that has more significance than a peal from the Liberty bell, a penny drops on the stage. Jerry overlooks it. Shortly another one comes down. The Master don't overlook this one because it falls between two bus bars on his highly complicated power transmitter.

Myself and the newspaper critics says the avalanche started then, but the musical director declares it really began with the first penny. Be that as it was, the short circuit started things. The Master happens to have hold of two loose wire leads, supposedly on a six-volt circuit. But the short threw in a dose of high frequency juice, and The Master gets a nice 10,000-volt jag on. He can't let go, but he can wiggle, and wiggle he does. The orchestra is playing a waltz as pit music, and the gyrations Jerry goes through broadcasts the idea that he's doing an eccentric dance. It's funny, and I ain't denying I woulda bust my sides if I hadn't known the truth. As it is the boys in the dime row goes wild. The stage electrician at last finds the right switch and The Master collapses in the middle of a Russian gazotsky. The audience applauds like mad, and I even hears one "Bravo!"

After Jerry is revived with a shot of hip courage, genuine, and which adds to the effect because somebody in the gallery smells it, the two dolls does their headgear hop to a heavy hand. The bunch is with us now. Then Jerry, very much shaken, nervous and stuttering, comes back to pull his radio-picture bit.

Jerry has been using a photo of the Prince of Wales to transmit, but something slipped and the stage hands lost the photo. The Master stands by the receiver all the time, where he can't see the picture on the transmitter. And the stage manager, not wise to the set system, puts in a snap of his youngest son, age four.

The Master, not seeing the wrong photo, announces that the transmission will take place and signals one of the girls to throw in the switch that starts the device. Baby boy goes into the ether and the Prince of Wales comes out.

The gallery don't quite get it until Jerry takes out the finished picture and advances to the footlights.

"And here we have the completed picture," he announces, smiling.

There's a snicker out front and instinctively The Master looks back. He sees his mistake. So does the audience. A roar goes up, plainly a roar of approval, but Jerry don't see it. He apologizes for his mistake, which makes it all the funnier because The Master is stuttering and the gang just eats it up. In desperation Jerry announces the feature of the act, Mr. Joe Hammerstein, the original toe-telegrapher.

The boys gives me a real hand when I steps on, and there's a moment's quiet while I puts on the shoes. Then The Master explains what I'm gonna do, and I skips over to the mat to do it.

I gotta hunch there's something rotten a lot closer than Denmark and I ain't wrong. The first step I takes I discovers a radical error. The stage hands has muffed some of the wires; every tap I make draws a six inch spark from the contacts on the mat.

The audience is surprised for a minute, but pretty soon they thinks they're wise. Because the radio speaker don't work, and all the noise there is comes from the sparks cracking outa my feet.

The gallery yells its approval, and the

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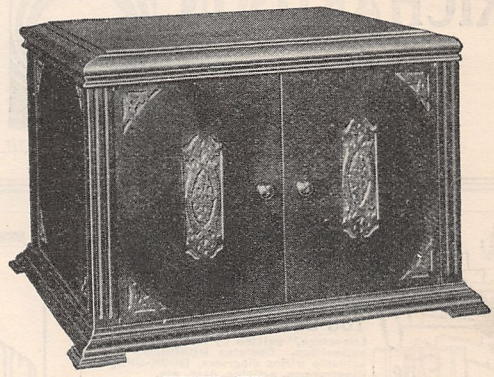
TRF-5

A 5-tube tuned radio frequency receiver consisting of two stages of tuned radio frequency of special design, detector and two stages of audio frequency.

Cabinet measures: height, 9⅝ in.; length, 20½ in.; depth, 14¾ in.

Without tubes, batteries or reproducer $125.00



TRF-50

This model is identical with TRF-5 but encased in larger carved cabinet with built-in Magnavox Reproducer.

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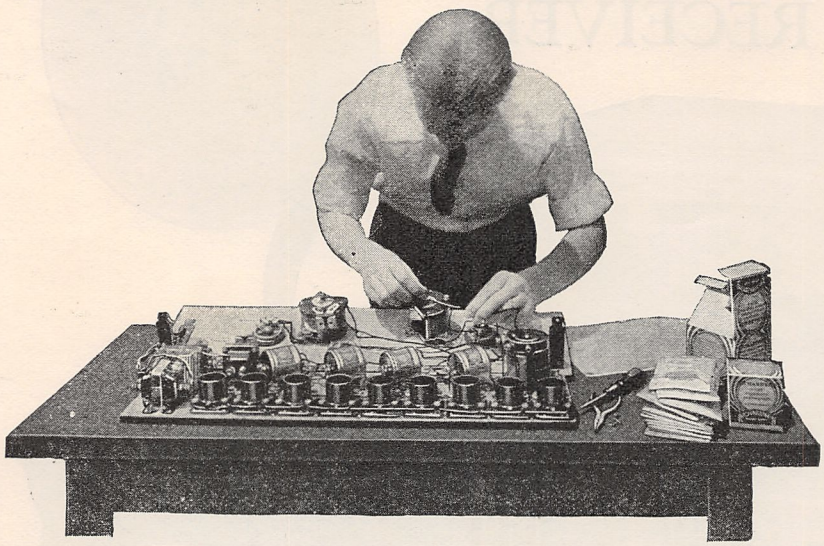

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stage electrician shows a little ingenuity by dousing the lights, leaving everything dark except for the sparks. It's pretty from out front, but my copper soles begins to get warm. I'm trying to help The Master all I can, so I sticks to the tapping. The copper plates is scorching the leather insoles, and my feet is almost baked, but I holds out until someone in the first-come-first-served yells "Hot puppies!"

I steps offa the mat, the lights goes up, and we gets a salvo of applause that would make synthetic gin taste like port wine. We takes nine curtains, closing the show, mind you, and The Master gets an extra bow. They wants a speech, but Jerry is plain dumb. Finally he manages to get offa the stage.

Everybody in back is chattering like the Friday Afternoon Embroidery League when The Master stumbles to his dressing room. He halts outside the door as compliments begins to rain down upon him, but he's deaf to them all. I takes a good look at him. He's almost crying!

"What's the matter?" I asks.

"My act!" he half-sobs. "It's ruined!"

"Ruined!" I echoes. "Man, you're made! Don't you see you've conquered the town's toughest audience?"

"But they—they laughed at me!" he weeps.

"Sure!" I replies. "If they hadn't, you'd have been sunk. As it is, you're set for the Palace as the greatest comedy scientist on the boards."

The Master looks at me for a moment. Then he throws back his shoulders and stands erect.

"Comedy—"

The door from the auditorium opens and in comes the house manager and two bookers. They seizes The Master's hands and pumps them like a milkman.

"Mr. Lawson, my compliments," beams the house manager. "Beyond question your act is the greatest comedy novelty I've played in years."

"You can close intermission at the Palace next week if you say the word," says a booker.

"And forty weeks to follow," adds the other.

By this time The Master is himself.

"Comedy novelty!" he snorts. "The very idea!"

"Sure," pipes the manager.

Jerry scowls. "After the treatment I received here do you possibly suppose I could ever face another audience?"

"Treatment?" mumbles the manager. "Whaddye mean?"

"Why," explodes Jerry, "they laughed at me!"

"Of course they did," says a booker. "What did you expect them to do?"

The Master raises his aristocratic nose a coupla inches.

"Gentlemen," he states, "I am a scientist, not a clowning zany. It is plain the vaudeville platform is not for such work as mine. I cancel the rest of this week and all the others. I shall remit my salary forfeit by check."

"Cancel!" sputters the manager. "You can't—you wouldn't—"

"But I would," says The Master, "and I do. Joe, you may have my drops and scenery. Gentlemen, good day to you." And he closes his dressing room door with a bang that means positively.

For a moment there ain't a sound. Then one of the bookers turns to me with a dazed grin.

"Say, Joe, was he born like that?"

I shakes my head. "I don't think he was born like that, but he's been interested in radio for many years."

"That," sighs the manager, "explains everything."

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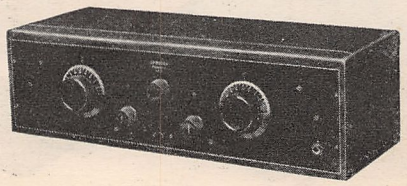

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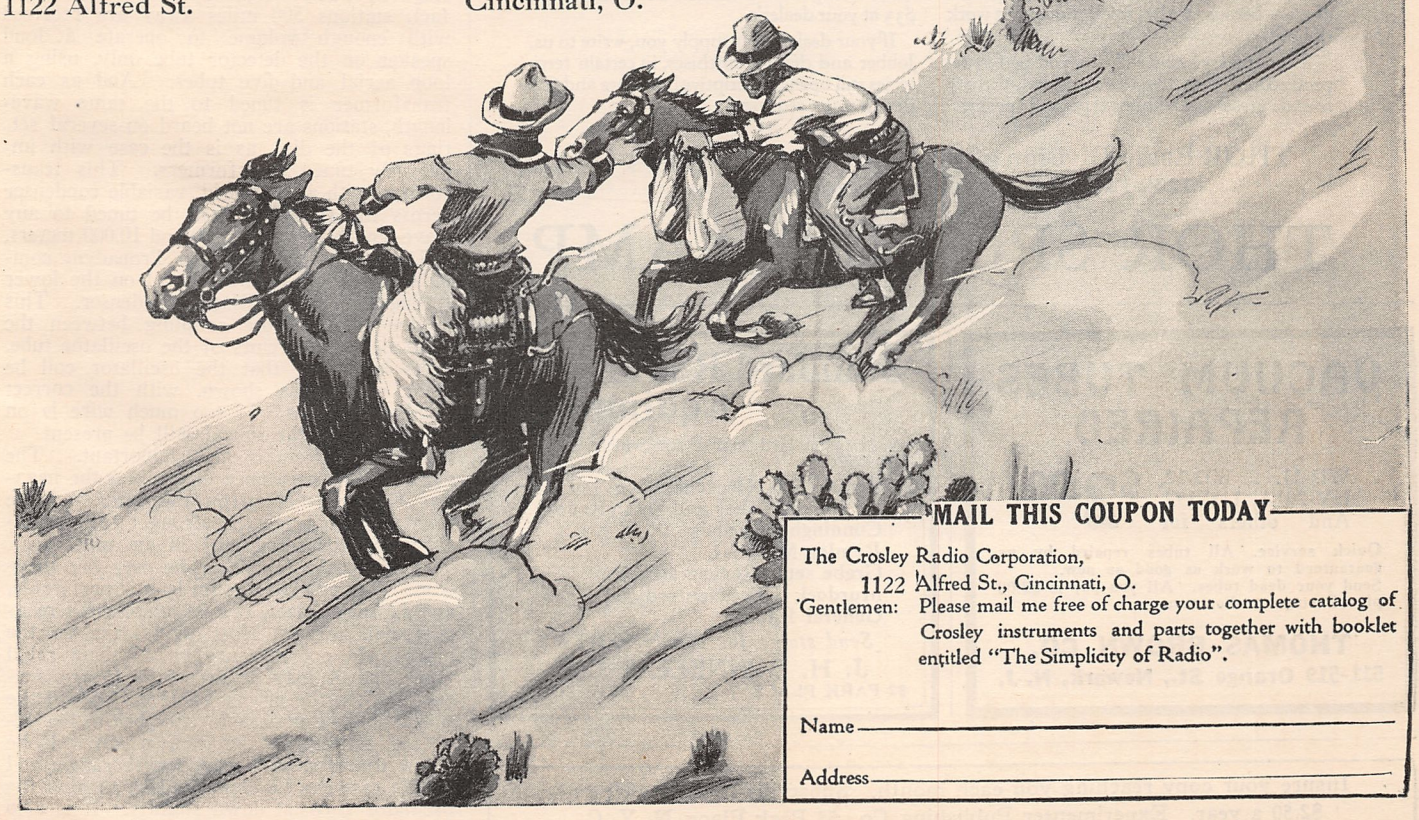

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The Four Electrode Vacuum Tube

(*Continued from page* 695)

act as an ordinary radio frequency amplifier. The amplified radio frequency current in the plate circuit is transferred to the crystal circuit by the transformer, T, the secondary of which is tuned by the condenser, C1. The oscillations in the tuned circuit, C1-L1, are rectified by the crystal detector, D, and placed on the second grid, G2, and amplified audio frequency impulses are obtained in the plate circuit. As the plate circuit carries both radio and audio frequency currents it is necessary to shunt a condenser across the "B" battery and phones to allow an easy path for the radio frequency currents. The condenser, C2, tends to improve the quality of the received signals.

Fig. 8 shows a diagram of the four electrode tube receiver designed and manufactured by the Marconi Company of England for use on ships. This circuit enables radio frequency amplification, rectification, and audio frequency amplification to be obtained from one tube. The radio frequency current variations in the second grid circuit are induced into the plate circuit through the radio frequency transformer, T, and the rectified current in the plate circuit is back-coupled to the first grid and similar but amplified impulses are produced in the second grid circuit. The telephones are connected in the second grid circuit through a telephone transformer. It will be noticed that Fig. 8 is somewhat similar to Fig. 6.

The writer hopes that the present article will be of some help to those who contemplate investing in four element tubes.

Notes On the Tropadyne

(*Continued from page* 691)

sured, which is practically equal to an extra stage of audio frequency amplification. In fact, stations 500 miles away are received with enough volume to operate a loud speaker on the detector tube only, using a loop aerial and five tubes. And as each transformer is tuned to the same wavelength, stations are not heard on several settings of the dial, as is the case with improperly tuned transformers. This transformer, with a .0005 mfd. variable condenser across the secondary, can be tuned to any wave-length between 3,000 and 10,000 meters.

Those who have built the Tropadyne complain of a high pitched squeal on the lower settings of the oscillator condenser. This is due to too close coupling between the plate and grid circuits of the oscillator tube. It is important that the oscillator coil be made exactly as shown, with the correct number of turns. If too much wire is on the plate coil, the squeal will be present.

The grid leak is also important. The value of this resistance determines the negative charge built up on the grid, and the greater this charge the stronger the oscillations and the squal puts in an appearance. The grid leak should not be over one megohm. A one-half megohm leak is preferable, and in some cases, one of one-fourth megohm will serve. Most grid leaks on the market do not measure up to their rated value and it may be necessary to try several. When the proper value is obtained the squeal will be noticeable only below the 10-degree setting on the dial, which will be below the broadcast wave-length range, and in this case can be eliminated by turning the oscillator rheostat down slightly. It is also important that the fixed grid condenser which

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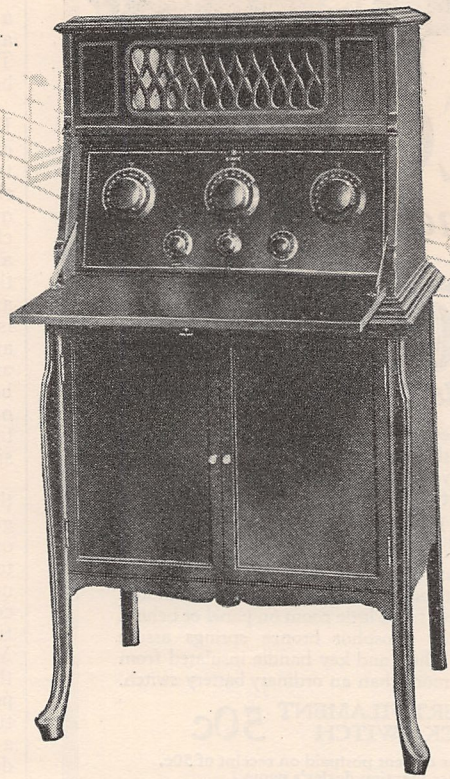

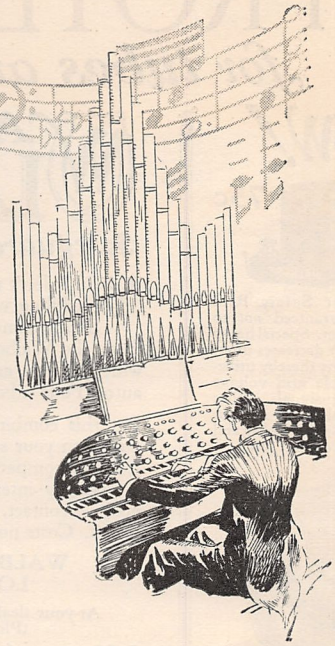

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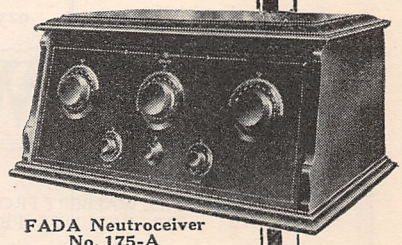

FADA Neutroceiver
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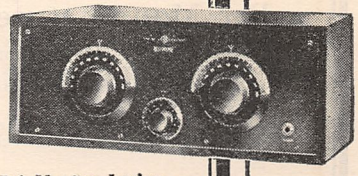

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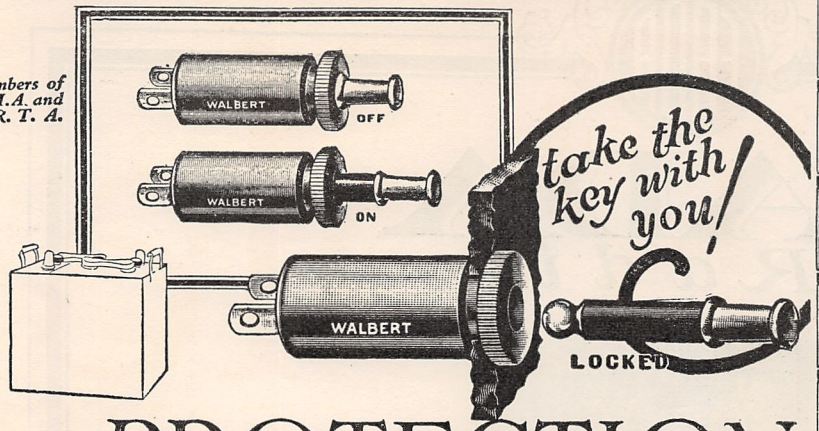

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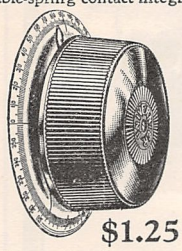

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Stations unheard before are tuned-in readily with the UNI-VERNIER, the original geared tuning dial. Gives 12-to-1 (micro-selective) control of any instrument. (A lower ratio is inefficient; a higher cumbersome and needless.) New "dished" dial and heavier mechanism. Positive vernier—No slippage! Pointer rigid with shaft.

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Safeguards Tubes and Batteries

YOU don't need to worry any more about someone meddling with your radio set while you are away. Simply remove the key (smaller than standard plug) from the Walbert Filament Lock Switch and take it with you just as you'd take the ignition key from an auto. Your tubes and batteries will be fully protected.

Put this combination filament control switch and safeguard on your set today. Attach it in a few minutes. It's very compact—takes little room on panel or behind it. Sturdy interior phosphor bronze springs assure positive contact. Shell and key handle insulated from circuit. Costs no more than an ordinary battery switch.

WALBERT FILAMENT LOCK SWITCH 50c

At your dealer or sent postpaid on receipt of 50c.
(Please mention dealer's name.)

Jobbers and Dealers: Write for Discounts.

THE WALBERT MANUFACTURING CO.
923 Wrightwood Avenue Chicago, Illinois

WALBERT
Parts with a Purpose

Send 2c for UNIVERNIER Log-book.

ALL WALBERT PRODUCTS PROTECTED BY PATENTS OR PATENTS PENDING, U. S. AND FOREIGN

PANEL ENGRAVING
For Manufacturers

A small but probably very important feature of your sets is the engraving on the panels. People buy attractiveness. Are you overlooking this?

Accurate machines and expert engravers. Largest facilities for this class of work.

Write *now* for quotations on lots of 25 or more.

GEORGE T. SCHMIDT
1800 Belle Plaine Ave., Chicago, Ill.

SURE-FIRE D-X CRYSTAL

THE BEST THERE IS

Extraordinarily supersensitive all over. Ideal on Reflex circuits. Tested, sealed, guaranteed. Indorsed by N. Y. Mail and Tribune.

50c. Mtd. at all dealers or sent postpaid.

Specialty Service Co., 9 Hanson Pl., Bklyn, N. Y.
Radio, Ltd., Montreal, Can. Canadian Distributors.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

connects to the center tap of the oscillator coil be of the correct value of .0005 mfds.

Those who wish to build the Tropadyne more compactly in a smaller cabinet have expressed a desire to omit the antenna coil and use one filament rheostat for all tubes. The antenna coil may be eliminated without affecting the other apparatus at all. Practically as good results and greater selectivity can be obtained when using the loop as when using an outdoor aerial. It is advisable to omit the loop jack also and connect the loop to two binding posts on the panel. The loop leads should be short and separated.

Regarding the rheostats—it is well to use a separate 30-ohm rheostat for the oscillator and a 6-ohm rheostat for all the other tubes. The tuned intermediate transformers can also be placed close together.

As many changed their standard Super-Heterodynes into Tropadynes they removed one tube in doing so, and wanting to use this tube, requested a circuit showing the connections of a stage of short wave radio frequency amplification before the frequency changer. We have tried this scheme and also tried the stage of amplification after the frequency changer, but although stations are received with greater volume, the tuning is more difficult and causes much squealing and noise. This is due to the fact that the amplifier tube oscillates occasionally and heterodynes the signals, making the regular oscillator inoperative. There is no advantage in adding the extra stage, as the sensitivity is all that can be desired as it is.

A number of requests were received for the design of an oscillator coil that would get the "hams." As the "hams" are now operating on wave-lengths ranging from 5 to 200 meters, one oscillator winding cannot cover this range. For short wave reception an oscillator coil having a variable tickler or feed-back coil is recommended. Many of the double circuit tuners now on the market can be rewound for this purpose. The rotor should have only about 10 turns. The stator may have 20 turns with a center tap. A .00025 mfd. variable condenser may be used. For the tuning circuit a tapped loop is recommended, shunted by an 11-plate condenser. To avoid body capacity a shielded panel should be used. The coupling between rotor and stator may be set in the position which works best and then allowed to remain so.

HELIUM BROADCASTING TUBES

Helium tubes are playing a great part in the high frequency art today. You listen in to 17 of the largest broadcast stations using these tubes each evening. These are the first stations in the world to use the Helium atom as a carrier of radio frequency currents. It has been practically impossible to separate the Helium atom heretofore from other gases. The helium in these tubes is by far the purest in existence. There is practically no other gas mixed with it, otherwise the tube would become inoperative. These little carriers also cool the tube.

The cooling effect was kept in mind, so a metal air cooled tube was built and used to carry out the extensive experiments. During these experiments, it was found that when the tube containing the gas was kept cool, the gas itself was able to retain it in equilibrium and not become inactive.

Dangerous Aerials

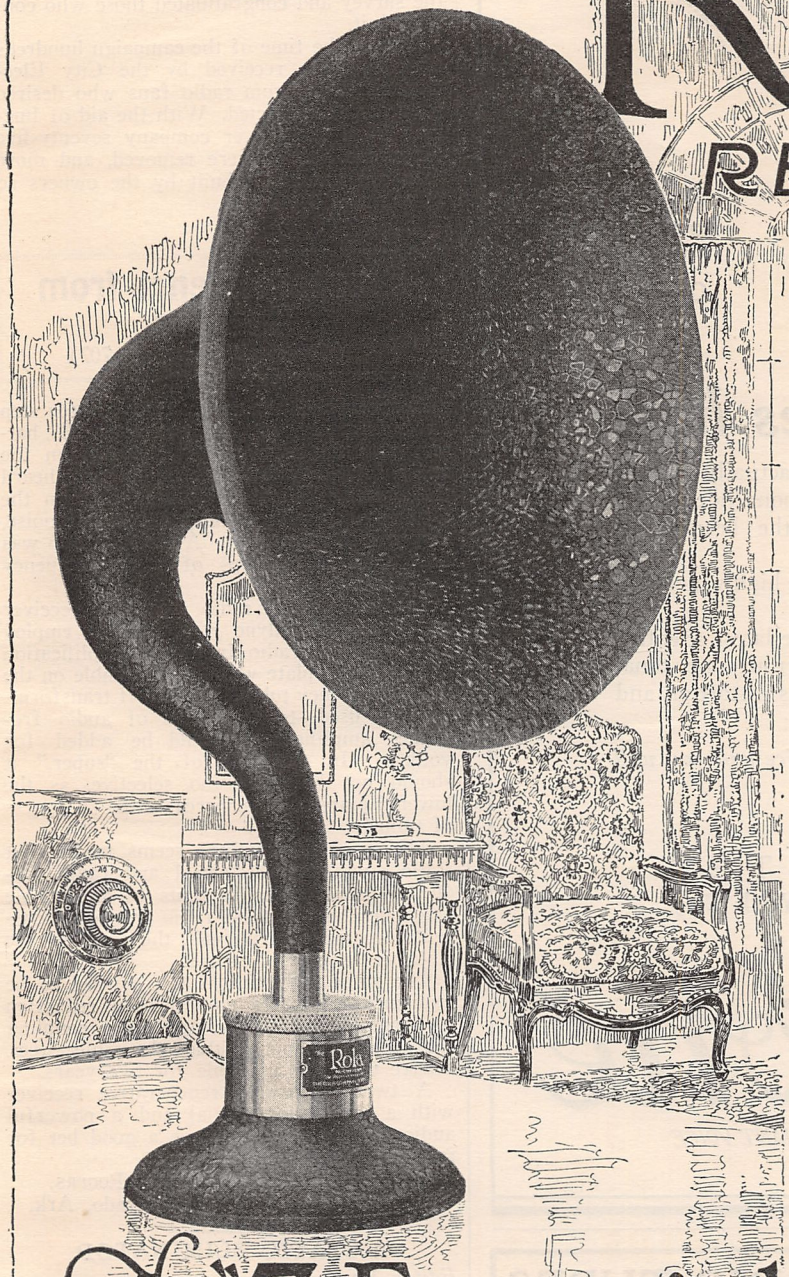
(*Continued from page* 670)

before the drive was begun regulating the erection of radio aerials.

Even the ordinance did not eliminate the dangerous aerials and so, following the fatality, steps were taken to once and for all to eliminate dangerous radio aerials.

The New Rola

RE★CREATOR



Volume!
Tone-Quality!
Sensitivity!

ONLY ROLA combines these three essential qualities in a single loud-speaker.

Volume without chatter, without discord, for dancing or outdoor reproduction.

Tone-Quality musically superb—attainable only by Rola's unmatched frequency range.

Sensitivity surpassing even the most sensitive headsets.

The new and wonderful Rola Re★Creator is truly the "3-Essential" Reproducer.

A trial, on your own radio set, will prove a revelation. See your dealer.

Price complete with 14-inch horn and cord, $36.00

Phonograph Unit with adaptor $22.50

A Product of

THE ROLA COMPANY

SEATTLE, WASHINGTON · USA

Jobbers: For sales information wire BAKER-SMITH COMPANY, Call Building, San Francisco, *National Sales Representatives.*

The "3 Essential" Reproducer

THE ROLA COMPANY
24 West Connecticut Street
Seattle, Washington

Gentlemen: Please send complete information regarding the new Rola Re*Creator.

Name _____

Street _____

City _____

My dealer's name _____

Volume!

$8.00

Patent Applied For

The Midget Loud Speaker With the Giant Voice

—and only 5 inches high

WITHOUT diminishing volume, but actually improving clarity and purity of tone, this bona fide midget loud speaker has achieved both the beauty and smallness that the home has long wanted.

The Reflectone is made from a beautiful, highly polished material simulating tortoise shell.

Its unusual tonal quality is the result of the latest scientific development whereby sound is reflected from one tonal chamber to another. This method eliminates distortion and amplifies the sound—*big.*

At your dealers, otherwise send purchase price and you will be supplied postpaid.

Write for descriptive circular

RICE & HOCHSTER

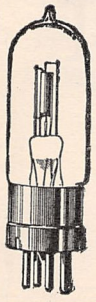
134 Washington Place New York City

Reflectone

THE MIDGET LOUD SPEAKER WITH THE GIANT VOICE

We repair the following RADIO TUBES

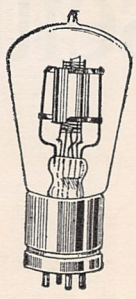
and Guarantee Them



WD-11	$2.50	DV-6	$2.50	UV-201A	$2.50
WD-12	2.50	DV-1	2.50	C-301A	2.50
UV-200	2.50	DV-2	2.50	Marconi	2.50
UV-201	2.50	DV-6A	2.50	Moorhead	2.50
C-300	2.50	UV-199	2.50	6 v. Plain Detector	2.50
C-301	2.50	C-299	2.50	6 v. Plain Amplifier	2.50

UV-202 Transmitter and C-302 ..... $3.50

Mail Orders solicited and promptly attended to
Dealers and Agents write for Special Discount



H. & H. RADIO CO.

P. O. BOX 22-H

CLINTON HILL STA. NEWARK, N. J.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

A representative of the Nebraska Power Company, City Electrician Lovett and a photographer toured the city and took photographs of dangerous aerials. The survey not only furnished photographs but furnished information by which the city was able to enforce the ordinance and order eliminated or reconstructed all of the dangerous aerials discovered.

The campaign carried on caused considerable comment among radio fans and radio dealers. The Electrical Industries Association of Omaha was very much impressed by the survey and congratulated those who conducted it.

During the time of the campaign hundreds of calls were received by the City Electrician's office from radio fans who desired their aerials inspected. With the aid of linemen from the power company seventy-five dangerous aerials were removed, and more than one hundred rebuilt by the owners so as to make them safe.

Correspondence from Readers

(*Continued from page* 707)

plification should be used. With a three step radio frequency set, and two volts "B" battery plus the regular "A" potential on the radio frequency tube plates, I have heard the Sweeny School at Kansas City on the loud speaker with scarcely a trace of noise, *during a thunderstorm.* A six foot loop was used with three steps of audio frequency amplification.

In a multi-stage radio frequency receiver or Super-Heterodyne it is best to employ three steps of radio frequency amplification and as low a plate voltage as possible on the radio frequency tubes. Three—if transformers are used—to five steps of audio frequency amplification should be added for volume. In the case of the "super," it should not be made too selective, as the lowered plate voltage increases the sharpness of tuning.

The principle involved seems to be that static modulates the aerial and radio frequency transformer currents at an audible frequency, and if these radio frequency currents are made very weak, the effect of the static is largely overcome.

The static reduction is too marked to be explained by either amplification reduction or increased selectivity, for loose coupling the aerial does not produce the same effect. I have used this principle for two years.

A twin variometer regenerative receiver with a very short aerial and a powerful audio frequency amplifier is a good bet for summer static.

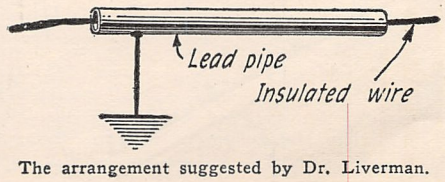
"Doc." Rogers,
Eldorado, Ark.

A STATIC ELIMINATOR

Editor, Radio News:

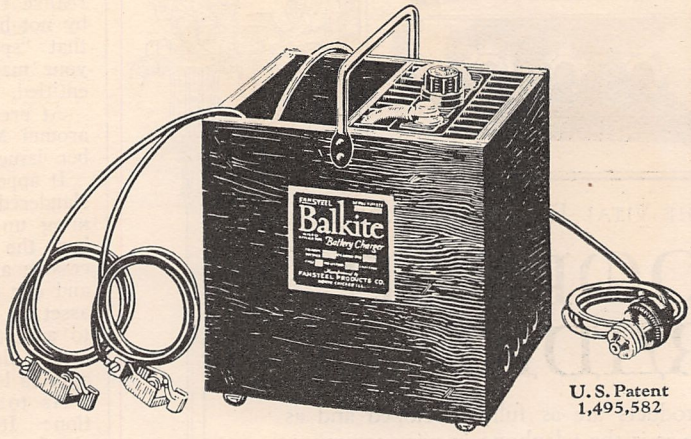
In your June number of Radio News I read in your article about "Money in Radio" that a prize of $500,000 is offered for a real static eliminator. May I inform you that I have cut out static entirely (this in Salzburg where during the summer months we have our daily thunderstorms) by leading the aerial through a lead pipe which is separately grounded.

Dr. S. C. Liverman,
Salzburg, Germany.



The arrangement suggested by Dr. Liverman.

TESTED AND LISTED AS STANDARD BY UNDERWRITERS' LABORATORIES



U. S. Patent 1,495,582

APPROVED RADIO NEWS LABORATORIES 1924

A noiseless battery charger

without bulbs, vibrators, or moving parts

The Balkite Battery Charger is entirely noiseless. It is based on a new principle, the use of Balkite, a rare metal which changes the ordinary AC current used for lighting to the DC current necessary for charging storage batteries, without the use of noisy vibrators, contact points, or fragile bulbs.

This charger has no moving parts, and nothing to break, adjust or get out of order. It cannot deteriorate through use or disuse. It delivers a taper charge, and cannot discharge, short circuit, or damage the battery by overcharging. It needs no attention other than an occasional filling with distilled water. It will charge a completely discharged battery. It is unaffected by temperature or fluctuations in line current. Its operation does not create disturbances in your set or your neighbor's. It is simple, efficient, cannot fail to operate if properly connected, and is practically indestructible except through abuse.

Because it is noiseless and does not create disturbances, *this charger can be used while the set is in use*, without affecting the set or its operation, and without disturbing sounds. Designed primarily for charging radio "A" batteries, it can also be used, without added attachments, to charge "B" batteries of the lead type. It operates from 110-120 AC, 60 cycle current, and charges the ordinary 6-volt "A" battery at 3 amperes. Special model for 50 cycles.

Sold by leading radio dealers everywhere. If your dealer cannot supply you, sent direct prepaid on receipt of price.

Manufactured by FANSTEEL PRODUCTS CO., Inc., *North Chicago, Ill.*

DEALERS: *Order through your jobber.* JOBBERS: *Write to our factory representatives. Where we have no representatives, write to us*

Factory Representatives

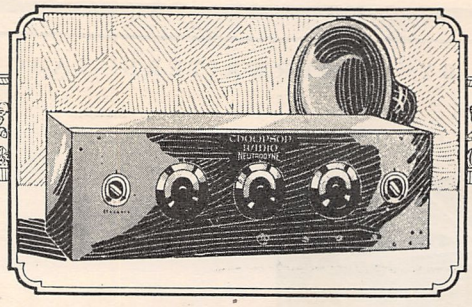
Ekko Company, 111 West Monroe Street, Chicago
J. P. Rainbault, 50 Church Street, New York City
Wood & Lane, 915 Olive Street, St. Louis
Chas. F. Saenger & Co., 919 Huron Road, Cleveland
Detroit Electric Co., 113 East Jefferson Street, Detroit
The Hoy Company, 719 McKnight Building, Minneapolis
A. S. Lindstrom, 111 New Montgomery St., San Francisco
Burndept of Canada, Ltd., 172 King St., W., Toronto, Ont.
Sparling-Markle, Ltd., 276 Smith Street, Winnipeg, Man.

FANSTEEL

Balkite Battery Charger

Price $19.50

West of the Rockies $20 · In Canada $27.50



"EXPERIENCE IS THE VITAL FACTOR IN EXCELLENCE"

THOMPSON RADIO

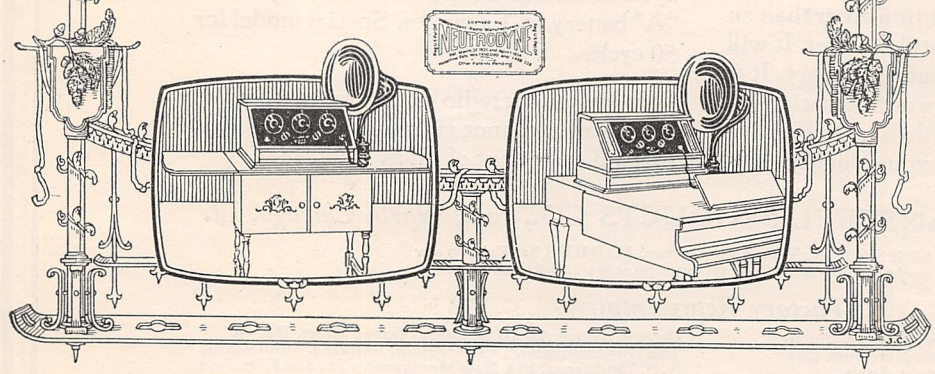
Thompson radio products are as fully developed and as standardized in radio as is the telephone in wire communication. Thompson owners do not worry about how their set and speaker will compare with "next year's model." Perfection remains Perfection.

Thompson simplicity of operation as well as Thompson range and power makes it possible to receive the desired radio program just exactly as it is given before the microphone. Those who wish *real* radio entertainment at low cost will be decidedly interested in the Thompson Neutrodyne Radio Receiving Set—*NOW* $125—and the Thompson Speaker—*NOW* $28.

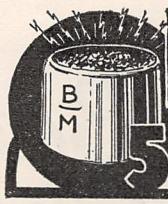
The fully developed Thompson Radio Products at such reasonable prices are possible only to an organization that has been making radio products *exclusively* for many years.

If your dealer does not handle Thompson radio products, write to us for descriptive literature and the name of a Thompson dealer near you.

R. E. THOMPSON MANUFACTURING CO.
Manufacturers of Radio Apparatus for the U. S. Army and Navy and numerous foreign governments
30 CHURCH STREET · · NEW YORK, N. Y.
FACTORY: JERSEY CITY, N. J.



ELGIN SUPER-REINARTZ
The Set Which Copied
2LO LONDON, ENGLAND
on
ONE TUBE
Send Stamp for Descriptive Circular
ELGIN RADIO SUPPLY CO.
207 E. Chicago Street, Elgin, Ill.



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50¢
'A real night and day, summer and winter crystal. Get it at your dealers.
B-METAL REFINING CO.
4th fl. 525 Woodward Ave. Detroit. Mich.

HUDSON-ROSS
Sells only nationally advertised radio apparatus.
Send for discounts.
123 W. Madison St. Chicago

Music Master
PROVEN RADIO PRODUCTS
MUSIC MASTER CORPORATION
10th & Cherry Sts., Philadelphia

FROM A SEAGOING OP.

Editor, RADIO NEWS:

Having read your worth-while magazine for more than four years, you can readily realize the mental anguish I have suffered by not being of literary talent and lacking that "spunk" required to answer any of your many letters published in the section entitled, "Correspondence from Readers."

At present my agitation is centered chiefly around Mr. Morrell's letter in the September issue.

It appears to me that the Hams have been slandered enough in these columns and summing up everything, each complainant has been the one to suffer most from each successive article as the Ham is here to stay and our government will protect him as an asset to our country as long as he agrees to accept legislation. But as I have said before that subject has been worn out long ago, so let us all let it die a peaceful death.

As to the commercial side of the question: It appears to me that anyone sufficiently acquainted with the code to copy at reasonable speed, would also have knowledge of the laws pertaining to decrement, that is, the sharpness of the emitted wave. Also he should be aware of the fact that when a good tuner is adjusted for, say, 600 meters, the operator will not be able to hear any broadcast if at any appreciable distance from the transmitting station.

I would be very well pleased to have Mr. Morrell and also the many fans advised that we are not delighting in spoiling their programs, but on the contrary, we wish for peaceful co-operation and the abandonment of such absurd letters as we see printed from time to time.

M. R. WILLIAMS,
Senior Radio Opr. S.S. *City of Cleveland III.*

WE ARE WITH YOU

Editor, RADIO NEWS:

I have just read the September issue of your magazine and want to tell you that I am delighted to find the "Sea Going Op's" with us once more. Keep up the good work.

I particularly enjoyed reading the article by Mr. Howard S. Pyle and the letters of Mr. J. Martin and Mr. Fred M. Howe. Mr. Martin certainly said what is commonly called a "mouthful" when he says that radio schools should include a course on conditions on shipboard in their curriculum.

Let's have more of "With the Sea Going Op's." and so make RADIO NEWS a magazine for the commercial operator as well as the amateur. Best of luck to you.

R. F. OWENS,
Opr. KEDX S.S. *West Hardaway.*

FROM A VETERAN ESPERANTIST

Editor, RADIO NEWS:

I was very much pleased to learn that RADIO NEWS has accepted Esperanto as the international language. No one who has given the question serious consideration will deny that an auxiliary language is necessary, and as international ties become ever stronger, the need for such a language will be felt more and more. To choose a national language was, of course, out of the question. There are so many forces working against such an idea that this busy world cannot wait for the final verdict. We need to solve the problem today, not a hundred or a thousand years from now. The solution undoubtedly lies in an artificial, or semi-artificial, language such as Esperanto. Now, out of the innumerable projects for an international language, Esperanto is the only one that has met with sufficient success to warrant its existence. To consider any of its rivals is as foolish as to compare a little local radio sheet with RADIO NEWS and say

GILFILLAN NEUTRODYNE

STYLE GN-1

In an artistic two-tone American Walnut cabinet harmonizing with any interior Price without loud speaker, phones, tubes or batteries **$175.00**

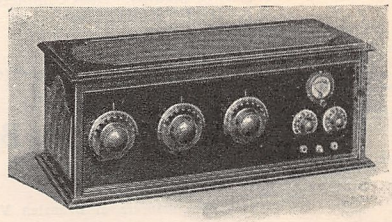
The Christmas Radio Gift!

Select your Christmas Radio gift for Performance and appearance. The Gilfillan Neutrodyne has wonderful clarity, ample volume and exceptional selective power. Programs come in from far and near—equally clear—and without interference, howls or squeals.

Parts for Gilfillan Neutrodyne sets are made, assembled and finally inspected in Gilfillan factories. That is why every Gilfillan Neutrodyne set gives the best results in reproduction.

The cabinet is made of selected American walnut in two tone finish—will look handsome in the modest or richly furnished home.

A GILFILLAN NEUTRODYNE makes a most beautiful and enjoyable Christmas present. Send for literature to nearest office.



Style GN-2 has the same NEUTRODYNE construction and features in a smaller cabinet. Price without loud speaker, tubes, phones or batteries **$140.00**

Jobbers and Dealers write for special sales proposition

GILFILLAN BROS. INC.

KANSAS CITY
2525 W. PENN WAY

1815 W. 16th St., LOS ANGELES, CAL.

NEW YORK CITY
225 WEST 57TH ST.

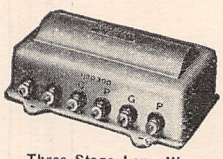
GILFILLAN RADIO CORPORATION
LICENSED BY
Independent Radio Manufacturers Inc.
Reg. U.S. Pat. Off.
NEUTRODYNE
Reg. U.S. Pat. Off.
Pat. Mar. 27, 1923 and April 4, 1924
Hazeltine Pats. Nos. 1,450,080-1,489,228.
Other Patents Pending

Branston Announces—

Eight Matched Transformers

$35.00

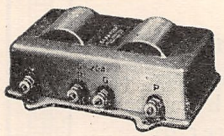
New Super Transformers and *New* Kit No. R-199



Three Stage Long Wave R.F. Transformers

Contains three perfectly matched long wave transformers each designed to give highest voltage amplification per stage without distortion.

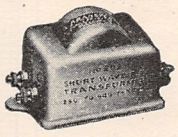
PRICE $13.50



Twin A.F. Transformer No.204

Two carefully designed A.F. Transformers in one unit, giving all the amplification possible, with wonderful tone reproduction throughout the musical scale.

PRICE $8.00



Single Stage Long Wave R.F. Transformer No. R205

Gives highest amplification on long wave or Super Heterodyne circuits. None more efficient at any price.

PRICE $4.50

No. R201—Long Wave Tuned R. F. Transformer....$4.50
No. R203—Special Tuned Coupling Transformer $4.50

Short Wave R.F. Transformer No. R202

Efficiently designed Short Wave R.F. Transformer with self-supporting coil windings. Will function with maximum amplification over entire broadcast wave band. Excellent for your Reflex Set.

PRICE $4.50

Designed by an engineer who has specialized in Super Heterodyne construction. He had tried all standard makes of transformers but none would give him the results for the perfected *strictly loop* set he desired.

He wanted a receiver that would amplify distant stations to the volume of a local station. This was accomplished by embodying short wave radio frequency into the set.

Present receivers were too bulky and required eight, ten and more tubes. By making various tubes do double duty, he was able to reduce the number to seven 199 or 201A tubes, and reduce the size of the panel required to 7" x 21".

In order to eliminate unnecessary detail in constructing, to simplify wiring, and beautify the panel layout, the three long wave R.F. Transformers were embodied in one compact unit and the two Audio Frequency Transformers in another, saving space, permitting short leads and greatly increasing efficiency.

Only two tuning controls are required allowing accurate logging of stations.

His greatest task was designing the transformers. After a year of constant research, he was satisfied with results—a receiver that could accomplish just a little more than others, greater distance, greater selectivity, ease of tuning and almost perfect reception.

We now offer these transformers, precision built, to handle the radio energy with superior accuracy and extraordinary efficiency.

Every kit is perfectly matched to the same resonant frequency. Each transformer besides being tested for mechanical and electrical defects is given an oscillation test. Every one absolutely guaranteed.

Complete blue-prints and layouts covering Super Heterodyne, Radio Frequency and Honeycomb Coil circuits sent for 25c in coin or stamps. Also complete catalog of BRANSTON QUALITY RADIO PRODUCTS.

Your Dealer has Branston Kits or can get them for you.

CHAS. A. BRANSTON, Inc.

817 MAIN STREET BUFFALO, N. Y.

Manufacturers of Branston Violet Ray High Frequency Generators.

In Canada—CHAS. A. BRANSTON, Ltd., Toronto, Ont.

MAKE MONEY SELL MADISON SHIRTS

Direct from our factory to wearer. Easily sold. Over one million satisfied wearers. No capital or experience required. Large steady income. Many earn $100. to $150. weekly. Territory now being allotted. *Write For Free Samples.*

Madison Mills Mnfrs, 566 Broadway, New York

Distance! The Only AUTHORIZED COCKADAY COIL

Gets distant stations easily and clearly. Made in strict accordance with specifications by L. M. Cockaday, inventor of the famous Cockaday Four Circuit Tuner. Greater volume, sharper tuning, maximum selectivity. Guaranteed. At your dealers—otherwise write us direct.

Price $5.50

PRECISION COIL COMPANY

209-D Centre Street New York

Operate your radio from your lamp socket with a

Gould Unipower Battery

For complete information address

GOULD STORAGE BATTERY CO.,

30 East 42nd Street New York

Greater

Volume—Distance

Guaranteed

With the New Low Loss 180° Gold Seal-tuner

Special Genoflex Coupler for Reflex Circuit.

Hookup and Illustrated Folder for Stamp

THE PUTT ELECTRIC SHOP

ELKHART — — INDIANA

that the former should henceforth supercede the latter because of its superiority.

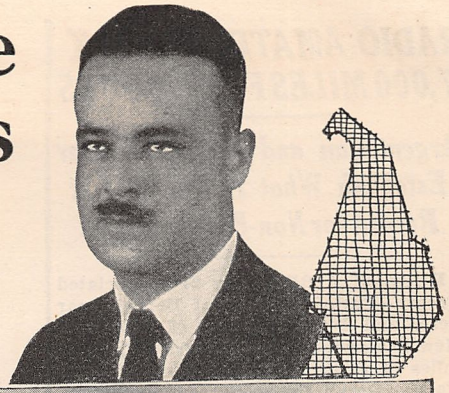
Those who find fault with Esperanto have almost invariably approached the language with biased minds, or if they have approached it with open minds they have not mastered it sufficiently to become accustomed to its peculiarities; for Esperanto, like any national language, has little peculiarities common to itself. It is true that Esperanto is not perfect, but the question is, *can* an international language be made perfect? I doubt it. No national language is perfect; all are full of incongruities, queer expressions, laughable idioms, etc., and yet each one of us loves his own national language because he has absorbed it since infancy and it has become the language of his heart. The more we study Esperanto the less artificial it becomes, and if a master hand gives us a piece of literature in the language it will give the well-versed Esperantist as keen delight as anything written in a national language. Esperantists everywhere will testify to that fact. Read Zamenhof's "Marta," for instance, and if you have absorbed the soul and spirit of Esperanto you will enjoy that story to the fullest extent.

Speaking once more of the defects (?) of Esperanto, what appears a defect to one will seem a perfection to another, and vise versa. However, if we approach Esperanto with the same frame of mind that we approach any national language, and then master it, the faults will melt as if by magic. By mastering the language I do not mean that we simply learn the grammar and vocabulary so that we can read and write the language fluently; I mean that we must read book after book of classic Esperanto until we have so thoroughly absorbed the soul and spirit of the language that it has become a living, throbbing speech.

Perhaps I may be pardoned for saying a word about myself. I have been as Esperantist since 1907 and have never lost faith or interest in the movement. The purposes to which I have put Esperanto have been wide and varied. I have written several small books in the language, also numerous magazine articles. To determine its universal applicability I at one time corresponded with Esperantists of no less than 30 different nationalities, the majority of whom did not understand English. During that same period, about 1910, I used the language for a unique commercial experiment. My home was in Tacoma, Washington, at that time. The Commercial Club furnished the local Esperantists with free quarters, and in order to partly repay this kindness it occurred to me that we might give the city some excellent free advertising in the various Esperanto magazines throughout the world—about a hundred in all. The result was interesting. A Russian bee-keeper, an ex-professor, wanted the Commercial Club to handle his honey which he called Esperanto, because, using his own words, "it was the most perfect honey, just as Esperanto was the most perfect language." A Belgian physician wanted to come to Tacoma providing the Commercial Club would guarantee that he could earn at least $10,000.00 a year. A Dutch cigar dealer of Rotterdam wanted to come to Tacoma and engage in the poultry business. He eventually came, bought a little land, began to raise chickens, fell in love with one of our Esperanto girls and married her—and they lived happily ever after. And so on. The Tacoma Commercial Club received letters from all over the world and the experiment proved quite conclusively that even at that time it paid to advertise in Esperanto.

I am convinced that Esperanto will play an ever increasingly important part in international affairs and those who have any international relations cannot afford to neglect the study of Esperanto. On the other

Tune in, and end those Super-Heterodyne Blues



Since the close of the great war I have been working on the simplification of Super-Heterodyne.

This done to my satisfaction, I said to our Laboratory Chief early last Fall, "Meissner, thousands of fans bless us for the Pink-A-Tone crystal sets with which they tuned in for the first time. Let's give them Super-Heterodyne."

So Meissner went to work on "input" and "intermediate frequency." He tried every available type of transformer. After months of costly experimenting he perfected the new Pink-A-Tone 150,000 cycle Transformers and Oscillator Coupler.

When friends hear my Super-Heterodyne they cannot believe their ears. A simple adjustment of two dials and Chicago Grand Opera or Georgia Minstrels are in the next room.

I began to supply hook-up and parts to a friend. He put them together and retailed them for $450.00 to $750.00 each. The other day he bought a Rolls Royce.

"Now, Meissner," said I finally, "how can we give it to the fans?"

"Suppose the fan could have your set on his work table before him," said Meissner, "while he put together the perfectly matched and balanced parts which you supply at cost, plus overhead, plus 10%!"

But Meissner had done even better than that.

He had taken life-size photographs, top and rear, and then made blue prints showing each part numbered and in place. From plates costing a round thousand dollars he had made life-size reprints of these photographs and prints, exactly as illustrated, of which a radio publisher said the other day, "I have never seen anything like them in all my life."

AFTER BUILDING

"I have built ten. Yours the best."
New York

"It works very fine. The —— is not in it."
Texas

"Surprised myself and many customers."
Louisiana

You may have a complete set for $2.00—on approval.

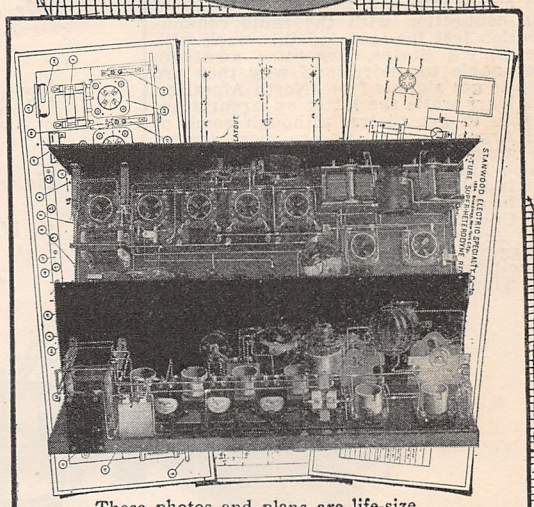
About intermediate frequency transformers. Upon their proper construction and balance depends the "equal amplification in each successive step of the signal as it is passed along from stage to stage," says Captain Robert Scofield Wood in a two-page description of Engineer Meissner's masterpiece in the New York Evening World's Radio Section.

That is why Meissner was not satisfied until he had built and balanced his own "heart of Super-Heterodyne," the wonderful Pink-A-Tone Transformers and Oscillator Coupler—see illustration above—which may be had, carefully matched, with life-size plans for $32.50.

The other parts necessary for the construction of this Super-Heterodyne that will not "repeat" (*no station comes in twice on the dials*) are pictured below. We sell, and like Captain Wood, urge the use exclusively of the best products of manufacturers like Pink-A-Tone, Bakelite, Paragon, General Radio, Hammerlund, Acme, Dubilier.

We will send all of these parts, carefully matched and balanced for you in our Laboratories, with life-size plans, complete, for about 10% less than list, or $80.00. Our references are the Publishers of any magazine in which our advertisement appears or any New York Bank.

THOMAS N. PINKERTON, *President*



These photos and plans are life-size.

Own the best—built with your own hands!

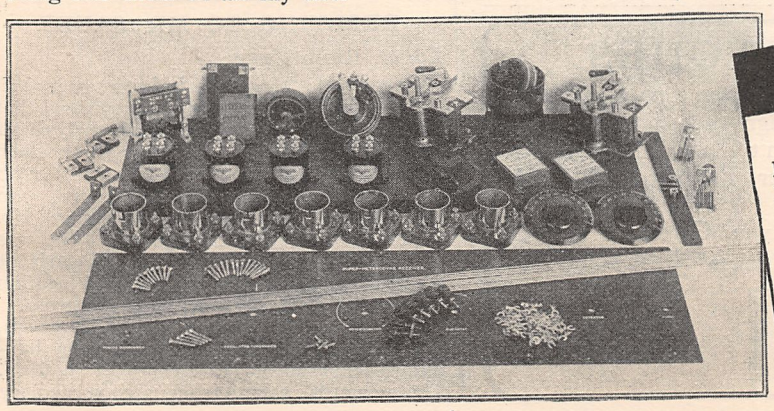
Our Service Department will help you out of any difficulty, by wire if necessary.

But do not make the *fatal* mistake of trying to use any but the best made matched and balanced parts for Super-Heterodyne.

Pinkerton Radio Corporation

SUPER-HETERODYNE EXCLUSIVELY

1834 BROADWAY NEW YORK CITY



Dept. 106

RADIOGRAM

Please send Photographs and Blue Prints, complete. On Approval—I enclose $2.00—.

Four matched and balanced Pink-A-Tone Transformers and Oscillator Coupler. I enclose $32.50— Or 25% C.O.D.—

Complete Pink-A-Tone Super-Heterodyne Kit at approx. 10% off list, $80.00. Or 25% for C.O.D. shipment.

NAME .....

ADDRESS .....

Remit by certified check or money order.

RADIO AMATEURS TALK 7,000 MILES FOR 2 HOURS

Argentinian and New Zealander Establish What Is Declared a Record for Non-Professionals.

BUENOS AIRES, May 24 (Associated Press).—Carlos Braggio of Bernal, near here, and Ivan O'Meara of Gisborne, New Zealand, radio amateurs with 7,000 miles of South American continent and Pacific Ocean between them, conversed for two hours by radio Thursday morning, establishing what is claimed to be a world's amateur radio record.

Braggio, who knows English, had spent most of the night unsuccessfully attempting to get some North American amateur to answer the signals of his station, CBZ8, when at 4 o'clock in the morning he was amazed to receive an answer from the other side of the globe —O'Meara's station, 2AC.

The amateurs opened a conversation which continued until 6 o'clock, when Braggio told O'Meara he had been up all night and wanted to go to bed. The New Zealander answered that he was sorry because it was only 9 o'clock in the evening at Station 2AC. Later on Thursday, Braggio received a congratulatory cable from O'Meara, confirming the conversation.

In connection with the radio communication test inaugurated this week with the United States, Argentine amateurs are unable to understand why they are able to get signals from North American amateurs while the latter apparently are unable to get theirs, although some of the Argentine stations are more powerful than some of the American ones which have been heard.

It is believed that many of the powerful broadcasting stations operating in the United States nightly interfere with the Argentine waves. In the future Braggio will try sending on a 120 meter wave-length at 3 A. M., Eastern Standard Time.

Argentinian and Jerseyite Exchange Radio Greetings

Special to The New York Times.

HARTFORD, Conn., June 2.—Two-way radio communication by amateurs between North and South America was attained for the first time last week by Norman R. Weible of Collingwood, N. J., and Carlos Braggio of Bernal, suburb of Buenos Aires. The feat was checked and verified today by the American Radio Relay League of this city, which tonight announced that Weible and Braggio had a twenty-minute connection on short wave lengths just before daybreak last Friday.

Braggio heard the New Jersey amateur calling him, and at 4:15 A. M. sent the following: "GM greetings and congratulations QRZ QRK."

Weible immediately replied in Spanish, "Saludo, Amigo de America del sur QRK."

A letter dated May 21, received today from E. J. Simmonds, an English amateur, stated he had heard the South American station transmitting.

Mr. Braggio Used

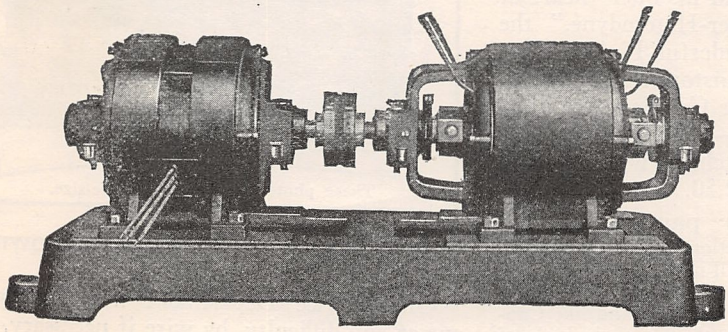
"ESCO"

Item 37—Double Commutator
1000 V. 600 W. for Plate
12 V. 300 W. for Filament

He writes:

"If I have the luck to be heard in the U. S. a great part of the success will be due to the good capacity of the "ESCO" set."

This is Item 37, used by CBZ8



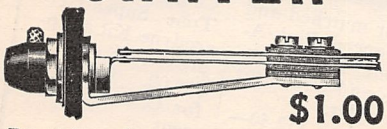
ELECTRIC SPECIALTY COMPANY

TRADE **"ESCO"** MARK

211 South St. STAMFORD, CONN., U. S. A.

Pioneers in developing High Voltage Apparatus for Wireless Operation

CARTER JACK SWITCHES



$1.00

Two springs, closes one contact; used to close "A" Battery circuit. Made also in three other spring combinations.

Carter stamp their name on their products, like you sign your name to your check. If it hasn't Carter's name on it, it isn't a Carter Product. The old timers have done the experimenting for you—they'll tell you, Carter's are best.

In Canada: Carter Radio Co., Ltd. Toronto

Any dealer can supply

Carter Radio Co. 207 S. STATE STREET CHICAGO

Insist on the original

hand, those who have no such relations, or those who never expect to go abroad, should not let that deter them from learning the language, for as a purely cultural subject Esperanto is by no means a subject to be scoffed.

LEHMAN WENDELL, D.D.S.,
615 La Salle Bldg., Minneapolis, Minn.

A FOLLOWER OF IDO

Editor, RADIO NEWS:

In the present stage of the development of an international auxiliary language nothing, it seems to me, really counts except the excellence of the language. There is, undoubtedly, an advantage in having some thousands of people scattered over the world who can speak such a language, but so far as the remainder of the world is concerned, and that means an overwhelming majority, the test remains the scope and accuracy and ease of acquisition and use attained by such a language. During the past fifteen years or more, Esperanto seems to have been working for diffusion while Ido has been working for self-improvement. As Daniel Webster said in a famous law suit about car wheels, "There they are; look at them." The deeper you look into these two languages, the more I feel sure you will realize their difference, and I shall be surprised if the difference is not ninety-nine per cent. at least in favor of Ido. In my judgment Ido represents a stage as far beyond Esperanto as the present coal burning locomotive does beyond the wood burning engine of my boyhood. Excuse me if I am intrusive; I only mean to be helpful.

H. L. KOOPMAN,
Librarian, Brown University,
Providence, R. I.

REGARDING ESPERANTO

Editor, RADIO NEWS:

I was very pleased with the article in the August number of RADIO NEWS concerning Esperanto. I think that Mr. Sayers described the situation very well, and hope that you will do all that you can to aid in the attempt to make this language the language of Radio.

I am not a subscriber to this magazine, and do not read it regularly, but, *believe me,* I got a copy of this number as soon as possible when I heard that RADIO NEWS was indorsing Esperanto. I have long felt it was only a question of time until some of the more influential radio fans would indorse Esperanto as the international telegraph language.

I am showing my copy of the August number to all my friends and many are getting copies to see what it says about the language. Many that have never manifested much interest in Esperanto now are showing signs of interest since they find it is mixed up with their one great hobby—Radio.

I hope to find more Esperanto comment in the magazine.

WARREN S. DAVIS.

REPLYING TO MR. SAUER

Editor, RADIO NEWS:

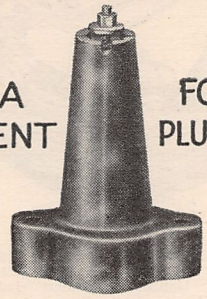
In reply to Mr. Sauer's letter, page 197, August, 1924, issue, I would recommend that he study Dyer's very impartial analysis of the RAIL situation. He makes the mistake of thinking Esperanto words started with Zamenhof. They didn't; the doctor, who did not know Spanish or Italian, as Mr. Sayers implies, was no linguist. He was not as good an Esperantist as de Beaufront who started the project which the delegation called "Ilo" in the official organ Progreso.

Dr. Zamenhof started with 925 words, which free lance authors swelled by haphazard experiments to 2,800 odd in 1923. These words came from the vocabulary

BARKELEW
RADIO ACCESSORIES

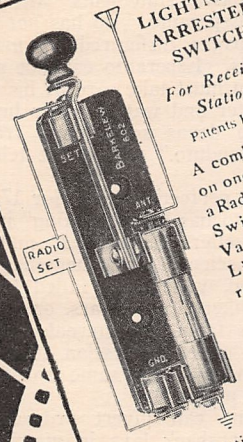
ANTENNA EQUIPMENT

FOUR PHONE PLUGS AND POSTS



PORCELAIN PEDESTAL
Brown Glaze
An insulator with a rigid clamp for the lead-in wire. A pedestal for spacing Ground Switches or other apparatus, 5" clear of the mounting surface.
Catalog No. 611 Price $0.40

LIGHTNING ARRESTER SWITCH
For Receiving Stations
Patents Pending

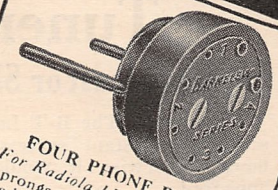


A combination on one base of a Radio Ground Switch and a Vacuum Tube Lightning Arrester.

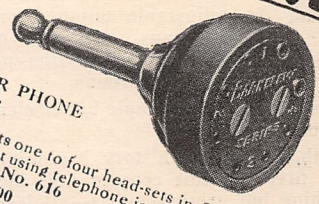
A distinctive device for those who know and demand the best lightning protection.

Approved by the Underwriters Laboratories.

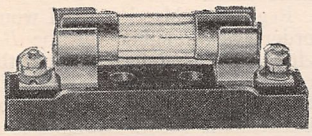
Catalog No. 602 Price $3.00



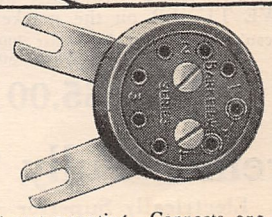
FOUR PHONE POST
For Radiola III and III-A
The prongs on this post fit through phone holes in the face of panel. It takes one to four head-sets in Series.
Catalog No. 624 Price $1.00



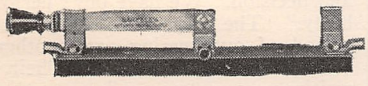
FOUR PHONE PLUG
Connects one to four head-sets in Series to any Radio set using telephone jacks.
Catalog No. 616
Price $1.00



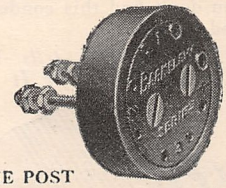
VACUUM TUBE LIGHTNING ARRESTER
Required on the antena of every Receiving Station. Approved by the Underwriters Laboratories.
Catalog No. 606 Price $1.50



FOUR PHONE POST
For binding post mounting. Connects one to four headsets in series to the more common types of brass phone posts.
Catalog No. 628 Price $1.00



GROUND SWITCH
Required on all Transmitting Stations—Built of 60 Ampere Copper
Catalog No. 600. Price $2.50



FOUR PHONE POST
For Panel Mounting. Connects one to four head-sets in series.
Catalog No. 618 Price $0.75

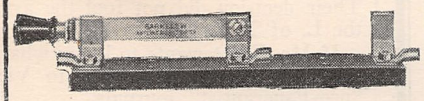
BARKELEW PRODUCTS
Have Merit and Reputation

THE keen buyer of radio material knows that some items can be purchased on their own merit, while others the reputation of the manufacturer is of first importance.

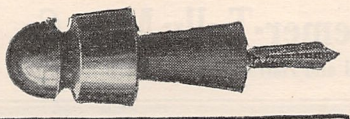
He is happy when he finds a fast moving, well advertised line with real merit and with a factory reputation backing it up.

The articles shown here have several successful years behind them [they are old for radio] and our eighteen years in electrical manufacturing surely count for something.

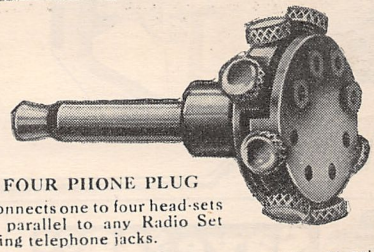
For full description of each item, see our new Radio Catalog No. 32 at your dealer. If he hasn't his copy, we have one for him.



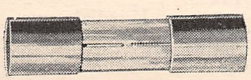
GROUND SWITCH
Required on all transmitting Stations. Built of 100 Ampere Copper.
Catalog No. 601 Price $3.15



"LEAD-IN" INSULATOR
For Receiving Stations
Spaces the "Lead In" Wire 5" out from the wall.
Catalog No. 612 Price $0.50



FOUR PHONE PLUG
Connects one to four head-sets in parallel to any Radio Set using telephone jacks.
Catalog No. 614 Price $1.50



VACUUM ARRESTER TUBE
Used in 602 Switch and 606 Arrester. Sold separately for replacement purposes.
Catalog No. 622 Price $1.00

The BARKELEW ELECTRIC MFG. CO.
Middletown Ohio U.S.A.

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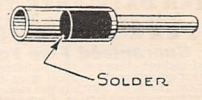
LOS ANGELES 443 S. Pedro St.
SAN FRANCISCO 75 Fremont St.



STANDARD CORD TIPS
If the wire is tinned they can be soldered on Phone Cord with a couple of matches.
Cat. No. 623 Price $0.05 ea.

An Innovation in Tuners

For Broadcast or Short Wave

No Wonder The B-T Low Loss Tuner scored an instant success. It had the merit, otherwise it would never have appeared.

Consider: 1st, A development in coil winding and arrangement so effective that the full broadcast range is covered with an 11-plate B-T Condenser—Results: Louder signals, more distant stations and greater selectivity.

2nd, An adjustable untuned primary, one of those things so simple no one thought of it—but it solves the problem of varying local conditions.

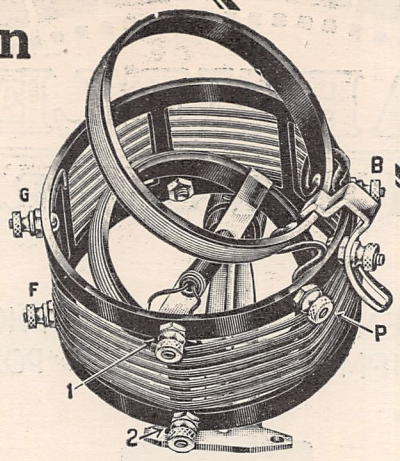
3rd, An equally simple but efficient loss-proof frame.

4th, A family history beginning with the first 3-circuit coupler and including nothing but original parts—all leaders.

5th, A record of its own of being the first LOW LOSS Broadcast or SHORT WAVE TUNER on the market.

You can't beat it For Broadcast 200-565 meters
For Short Wave 50-150 meters

Price $5.00



Broadcasting 200 to 565 meters. Short wave work 50 to 150 meters. (These ranges covered with B-T 11-plate "Lifetime" Laboratory Condenser.)

$5.00

P. S. If it's a 5-Tube set you want, read what George Colman, Kedvale Ave., Chicago, says:

"Am getting wonderful results with the B-T 'Nameless.' With four Chicago stations and Elgin going full blast, I am pulling in such stations as Louisville, Philadelphia, Detroit, Cincinnati, Davenport Pittsburg, Iowa City, etc Have had as many as 14 outside stations in an evening, regardless of Chicago. The 'Nameless' is all that's claimed for it." Write for descriptive folder.

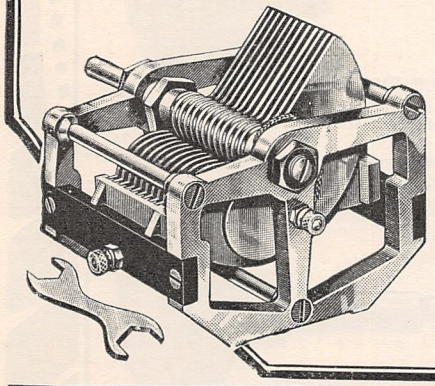
Bremer-Tully "Lifetime" Condenser

Electrically Superior — Mechanically Beyond Comparison

150 m.m.f. 7 plates	$4.25
250 m.m.f. 11 plates	4.50
520 m.m.f.23 plates	5.00
800 m.m.f.35 plates	6.50

If you don't find this condenser better —send it back.

"20 Point" Folder tells the details Write For It



The only Low Loss Straight line wave length condenser.

Grounded rotor and frame.

Light—compact.

A bearing that has no equal in radio. It can be adjusted without disturbing plate alignment or changing capacity.

Exclusive B-T method of die casting insures perfect contacts and spacing to within 1/1000 of an inch.

"Better Tuning" (now in 6th edition) tells you why and shows you how. Complete instruction and diagrams for progressive construction from crystal to Reflex and Radio Frequency circuits. Sent on receipt of 10c.

Bremer-Tully Mfg. Co.
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Save $38.80

Take advantage of the great saving we offer on the genuine, world-famous, **ball-bearing, long-wearing L. C. Smith Typewriter.** Late model machines standard size up-to-date in every way at remarkably low prices.

SEND NO MONEY

TEN DAYS' FREE TRIAL
Test it thoroughly—no obligation.
A YEAR TO PAY LOW PRICES EASY TERMS
Guaranteed Five Years

We do the most perfect and highest class job of rebuilding known to the typewriter industry. Our machines do perfect work and last for years and years. Just like new. The L. C Smith is the easiest machine to operate and you can easily type your own letters **Complete lessons** on typewriting also our **5 Year Guarantee with every machine.**
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SMITH TYPEWRITER SALES CO.
237-360 East Grand Avenue Chicago, Illinois

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B and FLASHLIGHT BATTERIES
ELECTRICAL MANUFACTURERS' AGENCY
25 North Dearborn Street Chicago

Ford Runs 57 Miles On Gallon of Gasoline

A new automatic and self-regulating device has been invented by John A. Stransky, 3914 Fourth St., Pukwana, South Dakota, with which automobiles have made from 35 to 57 miles on a gallon of gasoline. It removes carbon and reduces spark plug trouble and overheating. It can be installed by any one in five minutes. Mr. Stransky wants distributors and is willing to send a sample at his own risk. Write him today.—Adv.

Coto
"Built First to Last"
GUARANTEED RADIO PRODUCTS
Coto-Coil Co.
Providence, R. I.

Insure your copy reaching you each month. Subscribe to Radio News—
$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

squeezed out of eight modern languages before Zamenhof was in the field.

The work was done by Rosenberger, Peano and others. So do not call the synthetic basis of all modern schemes, Esperanto, Mr. Sauer.

My "enthusiastic statements" are *not* all applicable to Esperanto. Ilo has *not* 30 per cent. of its pages disfigured by artificial, invented words. Esperanto can not say "A man or woman must take care of his or her brother or sister and watch his or her conduct"—"Homo devas sorgar sua frato ed atencar lua konduto." Ilists cut telegraph bills.

Ilo has been perfecting itself for 17 years, while Esperanto has been "barking" in front of the "booksellers' tents." It matters a great deal to scientists whether they use a childish jargon, which has failed to make good with thinkers in 37 years, or a system which is free from all internal ideas and aims to give exact expression to thought. Latin and Ilo have the same spirit; they are exact and practical.

No magazine can divert progress, and when Mr. Gernsback lays in matrices for Esperanto texts it will be time enough for our opponents to congratulate themselves.

Ilo is not reformed Esperanto, but Dr. Zamenhof's friend de Saussure HAS reformed the Esperanto grammar and spelling so as to look like English and not a Prague news sheet.

Regarding Mr. Woolf, I would suggest he order back numbers of the *Boston Sunday Advertiser* and re-examine the article he criticized. There are several Ilo radio fans given there. Edgar Turle, of Deerhurst, Beckenham, Kent, England, is a likely prospect.

Mr. Woolf has the idea that Ilo comes from Esperanto. So does man from the ape? but—I'm not an Esperanto "funnymentalist!"

Regarding Mr. Frost: Ilo has *not* been materially changed. It has grown from 3,000 to 11,000 roots by discussion, trial and decision. We have our "periods of stability." The Esperantists have a perennial period of outguessing one another in individual word formations. Their technical writings are a "scream."

Mr. Frost has to think that Ilo must be a "paint brush" because it is a "tool." This Lord Dundreary style of comment shows that the need of logical exactness does not appeal to the Esperanto mentality. Some of the best Ilists are men who abandoned the idea "that logic is a complication." The Paris Chamber of Commerce invited Esperantists to show their wares and ignored the Ilists. Their decision did not fool the assembly of the L. of N.

If Mr. Frost wants to know what is going on in Moscow, don't apply to Vienna and "pro-Esperantist" journals.

The Communists (and "La Presse," Canada, was accused of being "red" when it took up Ilo!) have "Nia Standardo," and Yushmanoff, who has written "100 Defects of Esperanto," is right in the thick of the movement.

I speak and read Russian and during the war studied Russian mythology in the N. Y. Tory Press.

Kordiale vua,

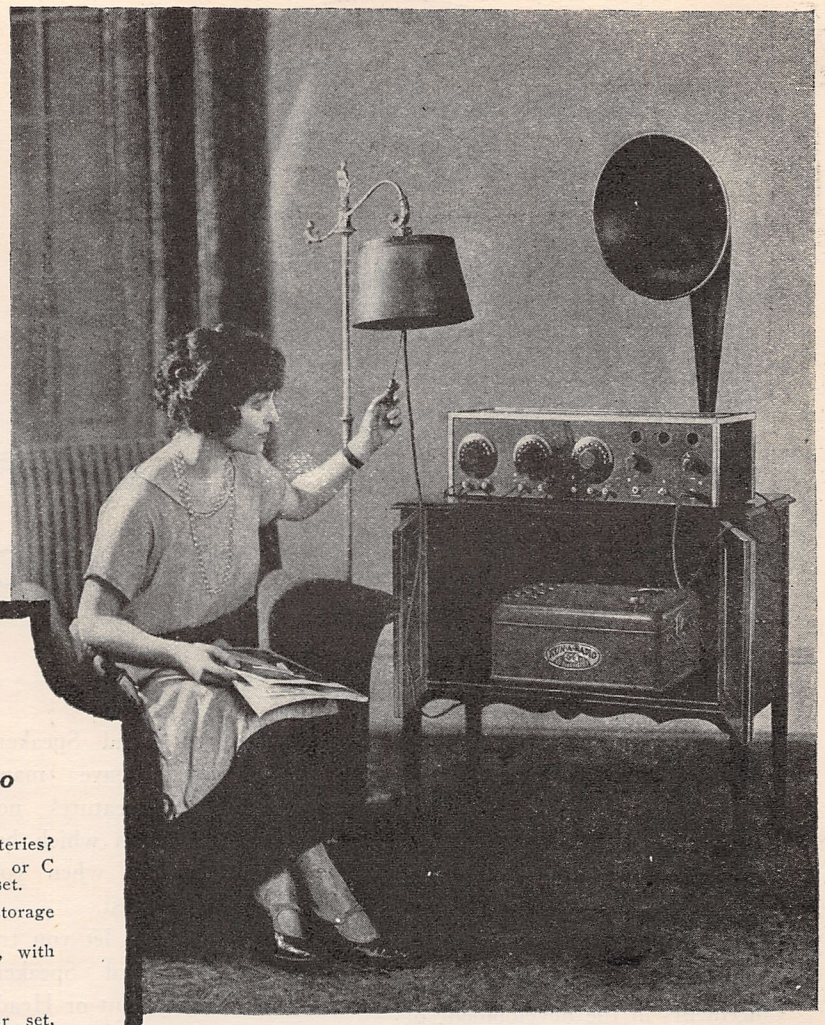
O. C. Roos,
Boston, Mass.

FROM ANOTHER VETERAN EXPERANTIST

Editor, RADIO NEWS:

I congratulate you for the laudable, progressive step you have taken in deciding to support Esperanto as the international language. When it first reached this country 10 years ago, I was one of the first adherents. Since that time there have been but

No more Radio Batteries!



RUN-A-RADIO
ELIMINATES ALL RADIO BATTERIES
Gets A-B-C Radio Power from Light Socket

The Whole Story of *Run-a-Radio* In Ten Questions

1. Q. Does Run-a-Radio take the place of all batteries?
   A. Yes. With Run-a-Radio you need no A B or C batteries whatever, to operate your radio set.
2. Q. Will it work with either dry cell or storage battery tubes?
   A. Yes. More volume is obtained, of course, with storage battery tubes.
3. Q. How does it work?
   A. You simply connect Run-a-Radio to your set, and plug it into the light socket. Turn on your radio as you turn on your light. There are models for both A C and D C current.
4. Q. How much does Run-a-Radio cost to run?
   A. About as much as one electric light.
5. Q. Is it cheaper than batteries?
   A. Its cost is only a little more than regular battery equipment at the start, and it saves you about fifty dollars a year thereafter.
6. Q. Suppose I only want to take the place of B batteries?
   A. Use Run-a-Radio B, (a separate B battery substitute.)
7. Q. Will my radio work just the same?
   A. Probably better. Run-a-Radio makes it sound always just as it did when your batteries were new and in first-class condition. There is no hum or crackle as from depleted batteries. Distance as great or greater.
8. Q. Will it work on any radio set?
   A. Yes. Regenerative, neutrodyne, reflex, superhet, —Run-a-Radio runs them all. Guaranteed for one year.
9. Q. Can I carry it from room to room?
   A. Easily. It is about the size of a starch box and weighs only 40 pounds. Finished in rich mahogany or Brewster Green, crackle finish.
10. Q. Doesn't Run-a-Radio mean the end of all batteries in radio?
    A. Of course. It is the obvious last step in radio convenience. Soon no radio set will be considered modern without Run-a-Radio.

Read the story—look at the Picture—go hear Run-a-Radio at your dealer—and begin to really enjoy your set for the first time. You can prove to yourself that Radio batteries have gone for good, and Run-a-Radio has come to stay.

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Territories are now being assigned

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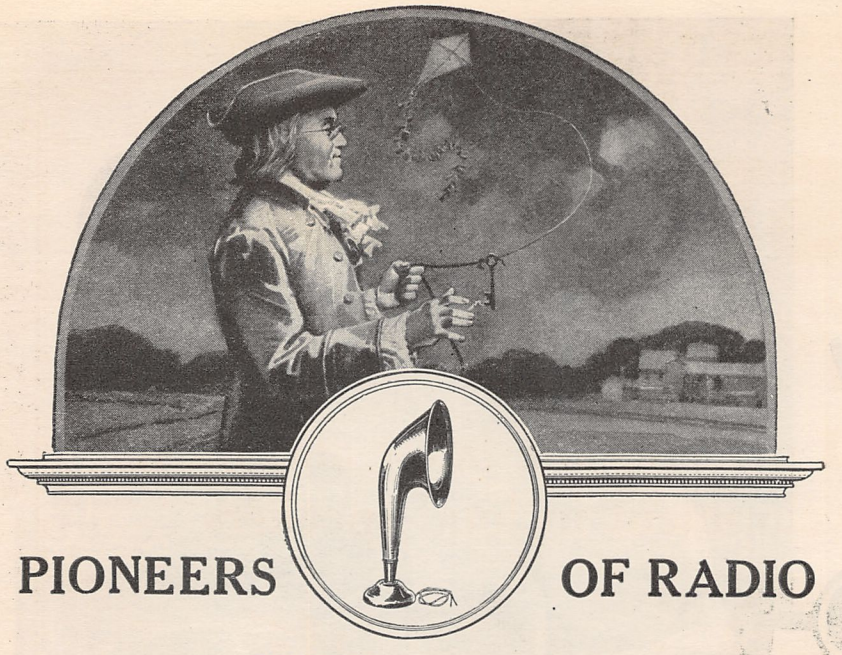
Send me without obligation information regarding Run-a-Radio and name of nearest dealer.

Name .....

Street .....

City .....



PIONEERS OF RADIO

BENJAMIN FRANKLIN
JUNE, 1752

FRANKLIN by his famous kite experiment, proving lightning an electrical phenomena, and conceiving the idea of plus and minus charges, was an important contributor among the many discoverers who paved the way for RADIO.

Holtzer-Cabot, over a period of thirty-five years has made many advancements in the development of intricate electrical apparatus for reproducing sound waves.

Holtzer-Cabot Loud Speakers and Headphones have many superior technical features not found in other makes which become quite apparent when you make a comparison test.

Ask your dealer to let you try Holtzer-Cabot Loud Speaker, Phonograph Attachment or Headset. The results will speak for themselves.

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The battery with a "second wind." You'll appreciate the added hours and weeks of unvarying performance.

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Dealers—Jobbers, Write for Proposition

BROWNLIE CRYSTAL

Guaranteed the Best $1.00

"REFLEX SPECIAL"
QUICK CONTACT
RECTIFIER
Withstands Heavy Plate Voltage
The Acme Apparatus Co. says "prevent distortion and howling by using a BROWNLIE CRYSTAL in REFLEX SETS."
Order From Your Dealer or Direct
ROLAND BROWNLIE & CO.
22 Saunders Street Medford, Mass.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

few people who wished to study it, because they had no need to. But with radio—"If the Mountain won't come to Mohammed, then Mohammed goes to the Mountain." "There's a reason" and a strong one to learn it now.

There are many people who think it is as hard to learn as the present foreign languages. I wish you would give aid to those by publishing a few lessons showing how easily it can be assimilated. It would be to everyone's advantage for you to obtain advertisements for Esperanto literature.

RAYMOND P. TIPTON,
Columbia, Mo.

AND STILL ANOTHER

Editor, RADIO NEWS:

Permit me to thank you for the publication of the article on Esperanto in the August RADIO NEWS, and for the step you have taken in deciding to support Esperanto as the international language for radio use.

I sincerely trust you can see your way clear to further aid the advancement of Esperanto by the publication of Esperanto lessons for the benefit of your readers.

I also take this opportunity to assure you that you will have my utmost support in this undertaking.

ROBERT S. WOOLF,
P. O. Box 103,
Blairsville, Penna.

What's the Matter With the Commercial Game

(*Continued from page* 710)

I told him all particulars of the episode and assured him that we were the only ones in those waters. We being at Lat. 46.30 N. Long. 177.00 E. He calmly stepped into the chart house located the Limy on the chart and told the navigating officer to steer for that position, then turning to me he said "Sparks find out all you can and keep in touch as much as possible for any particular changes." I went back to the shack all excited and the so-called Big Head stuff was coming out again, I made a schedule with the Limy for a later hour, as he was not in immediate danger, and went below.

The next day I was in the shack working the Limy giving him general information when the Old Man stepped into the shack and asked what was going on. Not looking around to see who it was I snapped out "Get out of here I'm busy." He evidently said nothing but went and left me there thinking I had shown my superiority over some deckhand or oiler that wanted to nose around. I made a schedule with Limy again and went below.

While I was telling the boys all about it one of the quartermasters came and told me the Skipper wanted to see me. I went to his room half expecting a good word and yet not knowing what to expect, upon entering. "You sent for me Sir?" YES . . . SILENCE . . . "Sparks you've been a fairly decent kid so far and I'd hate to see a distress signal get the best of you. That is the trouble with wireless operators these days, they get the idea that ships won't run without them, but you mustn't forget you're only here because the law requires it We used to get along without wireless outfits, you know, and we could still do it if it wasn't for the law requiring it. Did you ever have a job where the Captain didn't have any more use for the wireless operator than he did for one of the oilers?" "Yes Sir, the last job was like that," I replied. "Well do you know why that is?" "No Sir, haven't the slightest idea." "Well it's like

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FROST-RADIO presents the latest and most perfected development in loud speakers

Popularly Priced

$12.50
in black finish

$20
in silver or gold finishes

"TRUE REPRODUCTION *Musette* OF VOICE AND MUSIC"

The introduction of *MUSETTE*, the new **FROST-RADIO** loud speaker, has brought about a wonderful advance in the development of radio. You can purchase one of these new **FROST-RADIO** loud speakers with the assurance that all of the problems heretofore existing have been overcome.

True Tone Reproduction

In *MUSETTE* we have succeeded beyond every other manufacturer in securing a true reproduction of the human voice *and of all musical instruments.* This alone is a remarkable achievement. Our engineers, not satisfied with this, however, have designed a unit for *MUSETTE* which *covers the entire acoustical range.* There are no degrees of tone or pitch which *MUSETTE* will not reproduce faithfully and accurately, without distortion or harshness.

Note These Big Features

MUSETTE has a cast aluminum throat and base. This is the ideal acoustical material for the true reproduction of sound. *MUSETTE* has a specially designed unit, built according to the latest known discoveries of radio engineering. The bell is a richly beautiful single casting of polished BAKELITE, immensely strong, yet resilient and eminently satisfactory for this purpose.

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MUSETTE comes in a standard finish of black stipple base, with polished BAKELITE bell, complete with cord. It also is supplied in de luxe type with silver filagree finish base and throat, with black bell, and in a rich-looking gold finish base, with maroon BAKELITE bell. Silver and gold finish types are equipped with cord and plug.

No. 10B— **FROST-RADIO** *Musette,* black stipple finish, black bell..$12.50
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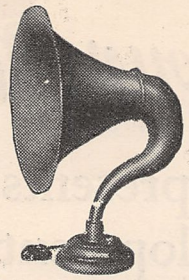
Trimm Concert Model Loud Speaker

The new Concert Model No. 80 is especially designed for high-powered, multi-stage, so-called Super sets. Combining the Trimm Standard speaker unit with a new and improved type of gooseneck horn, it will reproduce all the volume ever received from *any* radio without sacrificing the marvelous fidelity of tone, the clearness and distinctness for which Trimm Quality Reproducers are justly famous. An easily accessible, external adjustment provides instant control of tone and volume.



"Concert" MODEL 80 $25

Professional Headset $7.50

Dependable Headset $5.00

Trimm Headsets Proved Superior

Dr. Donald B. MacMillan, and the Hon. Wm. Hale Thompson, chose the "Professional" Headset after exhaustive tests proved it to be the most sensitive available. In the frozen North, and the blazing Tropics, this headset makes continuous communication with the far-away world possible. The "Professional" at $7.50 and the "Dependable" at $5.00 are two headset values unequalled in the radio world.

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RADIO MANUFACTURING COMPANY
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this—A Captain gets perhaps two or three bum operators in a row and the first thing he thinks is that they are all alike and when a good man does come along he can't get a good job, don't you see? Now all I want you to do is to try and be as congenial as you possibly can Sparks."

"I'll do my best Captain," "That's good Sparks and I'll see that this is the best job you ever had."

S. S. Thomas,
San Francisco, Calif.

CHANGE IN RATES FOR GERMAN STATIONS

On June 1 last the coast station rate of all German stations open to general public correspondence was changed to 30 centimes per word, minimum 2 francs, 40 centimes. The ship station rate, with the exception of the naval stations, the ship station Hertha (DHQ), and the ship station Odni (DOQ), was changed to 40 centimes per word, minimum 3 francs 20 centimes. The land rate was also changed to 15 centimes per word, minimum 1 franc 20 centimes, for ordinary radiograms, and 45 centimes per word, minimum 3 francs 60 centimes, for urgent radiograms.

CHANGE IN RATES FOR NORWEGIAN STATIONS

On June 1 last the Norwegian coast stations placed in effect a new rate, in that a charge of 4 francs 50 centimes (gold) will be made for each request made to a station and the reply thereto regarding weather messages, ice conditions, etc.

NOTICES TO MARINERS BROADCAST BY ARGENTINE STATIONS

The Argentine radio stations, Darsena Norte (north entrance to the port of Buenos Aires), in 34° 35′ 35″ S., 58° 22′ 10″ W., call signal LIH, and Comodoro Rivadavia (Gulf of St. George), in 45° 52′ S., 67° 28′ W. (approximately), call signal LIJ, are broadcasting important notices to mariners in Spanish and in English, there being an interval of one minute between the two bulletins. The first-named station broadcasts the notices immediately after the radio time signal at 22:00 civil time. The last-named station broadcasts the notices immediately after the first station has finished.

WILL SHORT-WAVE TRANSMISSION SOLVE PROBLEMS OF STATIC AND INTERFERENCE?

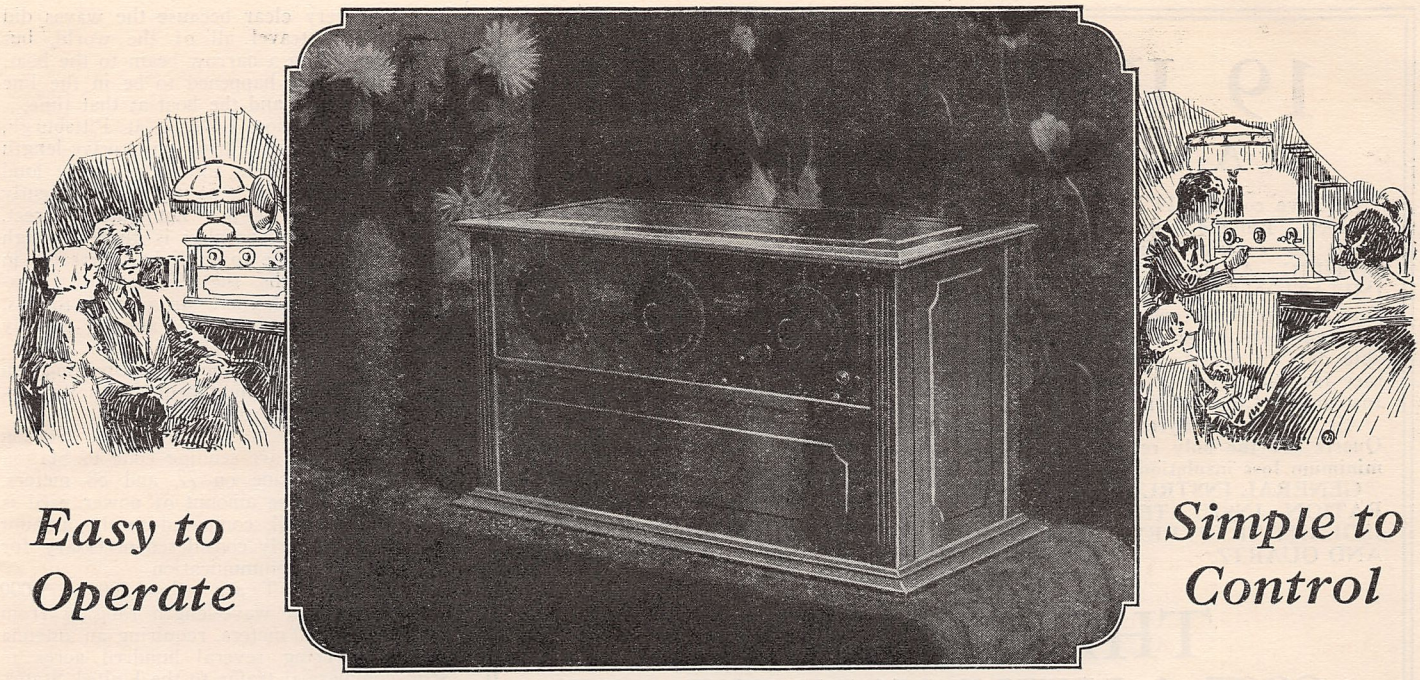
BY E. B. DALLIN
Research Engineer, Acme Apparatus Company

During the past two years amateurs have been doing very excellent work on short-wave transmission.

Last winter communication with England and France was quite a common occurrence between wave-lengths of 100 and 150 meters. Recently, amateurs in this country have been permitted to work on a few narrow bands of waves between 4 and 200 meters.

In May, 1924, at Cambridge, Massachusetts, I had the pleasure of hearing tests between the Marconi Station at Poldhu, England, and Marconi's yacht, "The Electra," transmitting on 90 meters. The signals were audible on a loud speaker with very good volume, and, strange to say, there was no sign of fading. The voice was remarkably clear and I heard the station at Poldhu at 7:00 p. m. several times while it was still daylight.

At Poldhu the signals were directed to Marconi's yacht by reflectors, which can be used very easily at those short wavelengths, and the amount of energy received



Easy to Operate

Simple to Control

WHEN you own a Radiodyne you can tune in on broadcast programs without wasting time tinkering. The Radiodyne shuts out interference from nearby stations. By simply adjusting the dials as indicated on the Radiodyne chart you can select the stations you wish to hear. All batteries are enclosed in the beautiful two-tone mahogany cabinet.

Uses a 25 Foot Lamp Coil for Summer Reception

"We are getting constant reception this summer from stations 500 to 1000 miles away on loud speaker with a 25 foot length of lamp coil. I got Los Angeles, San Francisco and Cuba."
Bernard S. Slay, Minneapolis, Minn.

RADIODYNE

Wife Gets Good Results After Two Minutes' Instruction

"I gave my wife two minutes' instruction and left her alone with the set. When I came back she said that signals had been roaring in all evening and had a log to prove it."
Robert Seldon Rose, Marquette, Mich.

Write for illustrated folder which describes the Radiodyne in detail. If you buy a radio before you have a demonstration of the Radiodyne you will surely regret it.

Western Coil & Electrical Co., 314 Fifth St., Racine, Wis.

19 IMITATIONS!

A RECORD COMPLIMENT

We have counted 19 imitations of our products. But the imitator cheats by offering the exterior likeness only. SCIENTIFIC ACHIEVEMENTS DEFY IMITATION. General Instrument Corporation eliminates and reduces losses in its condensers by scientific means available only to manufacturers with laboratory facilities equal to those of General Instrument Corporation.

Air, Isolantite, Pyrex, Corantum and Quartz are the only recognized zero or minimum loss insulations in existence.

GENERAL INSTRUMENT CORPORATION INSULATES WITH AIR, ISOLANTITE, PYREX, CORANTUM AND QUARTZ.

The embodiment of this scientific principle in General Instrument Condensers makes a certainty of GREATER DISTANCE, INCREASED SELECTIVITY AND CLEARER RECEPTION. By eliminating energy waste these genuine condensers overcome losses.

IMPORTANT: Pigtails introduce variable inductance and variable resistance, defeating accuracy and creating losses. The Bureau of Standards does not use pigtails on their standard variable air condensers. Neither does The General Instrument Corporation.

THE GENUINE

COST A LITTLE MORE BUT ARE

WORTH INFINITELY MORE

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Insulated With
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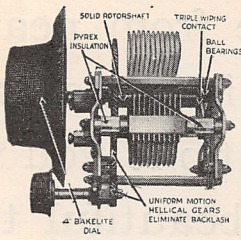
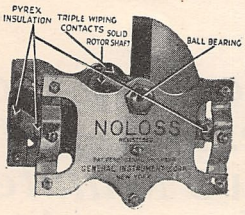
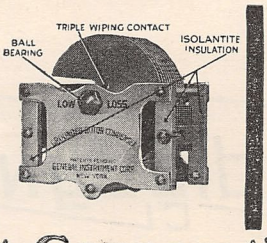


LOW LOSS
TYPE 46 TYPE 47
Insulated With
ISOLANTITE

TYPE 51



TYPE 46



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Van-Ashe Radio Co.
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TESTED HOOK-UPS
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WONDERFUL TRANSMITTER
BUTTON FOR LOUD SPEAKERS
AMPLIFICATION AND EXPERIMENTS

Price $1.00 POSTPAID with instructions

K. ELECTRIC CO.
15 PARK ROW NEW YORK

here was very clear because the waves did not have to travel all of the world, but were directed in a narrow beam to the boat. My own station happened to be in the line between Poldhu and the boat at that time.

Recently, Station KDKA, at Pittsburgh, Pa., has been transmitting on a wave-length of 68 meters and its signals are very loud in daylight, as well as at night. Apparently many old theories are not quite correct. The explanation probably is that although the absorption due to daylight is greater in these wave-lengths, the efficiency of transmission is much higher. In addition to this, the effects of static are almost entirely absent.

Station WGY is now transmitting on about 15 meters, simultaneous with its regular broadcasting on 380 meters.

Station POZ in Germany and Station UFT in France are sending code to Station LPZ in Argentine on 77 and 88 meters, respectively. The amount of power used is ridiculously small, compared to the amount of power formerly considered necessary for trans-Atlantic communication.

POZ and UFT are using 200 to 1,000 kilowatts and a wave-length ranging from 10,000 to 18,000 meters, requiring an antenna system covering several hundred acres to send commercial traffic to the United States, and the difficulties with static at these long waves are tremendous.

The most interesting thing is that there is room for all the stations in the world in very narrow bands of wave-lengths, since the difference in frequencies is very great. For example, 4 meters is equivalent to 75,000 kilocycles, and 5 meters is equivalent to 60,000 kilocycles.

It is only necessary to operate stations differing by a frequency of 20 to 30 kilocycles so that between 4 and 5 meters it would be possible to have from 500 to 750 stations, which would not interfere with each other, assuming that all stations were operating at the same time.

PROGRAM FOR BROADCASTING WEATHER FORECASTS AND REPORTS BY RADIO

NAJ, Great Lakes: (151 Kc.) 9:45 a. m.—morning lake forecasts; 4:00 p. m.—storm warnings; 10:00 p. m.—evening lake forecasts.

WLS, Chicago: (870 Kc.) 1:00 p. m. to 2:00 p. m., except Sundays (probably about 12 m. after Sept. 14)—morning state forecasts, general forecast, special forecasts, weather-crop summary on Wednesday, special warnings issued after sending hour, broadcast immediately.

KYW, Chicago: (560 Kc.) 12:00 noon (11:00 a. m. during local "Daylight Saving")—morning local forecast, state forecasts, lake forecast; special warnings at 2:15 and 4:15 p. m.; 9:25 to 9:30 p. m.—evening local forecast, state forecasts, lake forecast, aviation forecasts. Monday, "silent night."

WAAF, Chicago: (1050 Kc.) 10:30 a. m.—morning local forecast, state forecasts, general forecast, general weather conditions, aviation forecasts, shippers' advices during winter season, weather-crop summaries on Wednesday during crop season; 12:30 p. m.—repeats the 10:30 a. m. information, and on Saturday gives weekly outlook. Silent Sundays and important holidays.

WGN, Chicago: (810 Kc.) 10:00 a. m.—morning local forecast, state forecasts; 9:35 p. m. or later, at end of regular program—evening local forecast, state forecasts, lake forecasts, aviation forecasts, general forecast, general weather conditions. Monday, "silent night." Sundays and holidays irregular.

MAR-CO RADIO PRODUCTS CONDENSERS

The name "MAR-CO" on the carton—and one good look at the construction—is enough for those who know a *good* condenser when they see it!

MAR-CO CONDENSERS

43 plate		$6.50
23	"	5.50
17	"	5.00
11	"	4.50

without dials.

Choose the safe—and leak-proof way!

Specify MAR-CO whenever you buy radio instruments.

MARTIN-COPELAND COMPANY
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Allow us to quote on any parts or standard sets. Send 5c in stamps for catalogue.

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Western Electric	$9.45
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Pathe	$12.98
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Plugs Included

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Rectigon, 2 Amp.	$15.40
Rectigon, 5 Amp.	23.40
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Tungar, 5 Amp.	23.40
Ward Leonard, D. C.	9.75

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Fada	.60
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Fada	$ .79
Tillman	.35
DeForest	.50
Hoosick Falls	.75
Pacent 199	.40
Federal	.79
General Radio	.89
Workrite, 199	.60

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Como Duplex	$9.90
All American	9.50
Modern	10.00

TRANSFORMERS—AUDIO

Star	$2.95
Modern	4.25
Acme	3.50
All American	3.35
Federal No. 65	4.90
Thordarson	3.98
Jefferson No. 41	3.20
AmerTran	4.55
Erla	3.95
Federal No. 226	3.98

TRANSFORMERS—RADIO

Acme, R-2, 3, 4	$3.50
Acme 30K Super-Heterodyne	4.20
Tri Coil	1.90
Erla Reflex	3.95
Rasla RT6	3.00
Rasla CR	3.25
Owl	.65
UV 1714	3.60
RR 1716 Super-Het	6.75

DIALS

Amsco, 2 in.	$ .30
Amsco, 3 in.	.50
Amsco, 4 in.	.79
DeForest, 3 in.	.35
DeForest, 4 in.	.40
Pathe, 2 in.	.30
Pathe, 3 in.	.40
Pathe, 4 in.	.55
Federal, 3 in.	.50
Federal, 4 in.	1.15

VARIABLE CONDENSERS

General Instrument Lo-Loss. All sizes	$4.50
Heath Lo-Loss. All sizes	3.85
Heath Vernier Lo-Loss. All sizes	5.00

All Other Lines in Stock

VOLT METERS

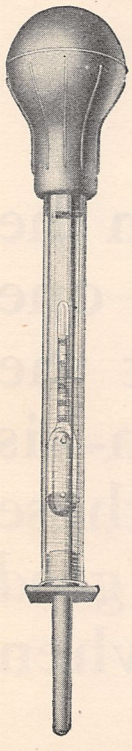
Jewel, 0-50 Volts	$2.25
Jewel, 0-12-120 Volts	9.85
Sterling, 0-50 Volts	1.75
Sterling, 0-35 Amp.	.89
Sterling, 0-35 Amp., 0-50 Volts, combination	3.00

ULTRADYNE COMPLETE, 8 Tube Parts, with Blue Prints and Connecting Wires $85.00
ULTRADYNE KIT 26.00
ULTRADYNE BOOK .50

The Brooklyn Radio Service Co.

Myrtle & Classon Avenues Brooklyn, N.Y.C.

Hafner-Meter for "A" Batteries



$1.00 Each

"Have a Hafner Handy"

Test your Batteries with

HAFNER HYDROMETERS

Specially designed instruments for testing both "A" and "B" batteries.

Floats have small glass beads to prevent sticking to the side of the tube.

They are also plainly marked for quick reading and will tell you at a glance condition of your battery.

Guaranteed Accurate

Can also be used to refill your battery with distilled water.

Hafner-Meter for "A" batteries.....$1.00
Hafner Hydrometer for "A" batteries..... .75
Hafner "B" battery hydrometer..... .75

Inquire of your local dealer. If he cannot supply you, remit to us together with his name and we will see that you are supplied.

Hafner Manufacturing Company

3132 Carroll Ave., Chicago, Ill.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

WOC, Davenport: (620 Kc.) 11:00 a. m.—morning local forecast, state forecasts, river forecast, general weather conditions, weather-crop summaries on Wednesday; 12:15 p. m.—forecasts repeated; special cold wave warnings sent as flashes. Tuesday, "silent night."

WJAN, Peoria: (1070 Kc.) 9:15 a. m.—morning local forecast, state forecasts, shippers' forecasts, general weather conditions, special warnings; repeated at 10:30 a. m. and 12:30 p. m.

WEW, St. Louis: (1072 Kc.) 10:00 a. m.—morning local forecast, stateforecasts, general weather conditions, river forecasts; special warnings at 5:00 p. m.

KSD, St. Louis: (550 Kc.) 10:40 a. m.—morning local forecast, state forecasts, general weather conditions, river forecasts and stages; special warnings at 12:40 p. m., 1:40 p. m., and 3:00 p. m.; 10:00 p. m.—evening state forecasts.

Amateurs receiving weather forecasts are requested to advise (by mail) Weather Bureau Office, Springfield, Ill., of the quality of service received and how distinctly the stations are heard.

WEATHER REPORTS ON THE GREAT LAKES

Weather forecasts, storm warnings and advices are now being broadcast from many stations located in all large ports of the Great Lakes. These weather forecasts and warnings are of inestimable value to all navigation on the Lakes, and especially to private motor-boat cruisers which constantly rove them during the summer. Nearly all of these small boats carry radio receiving sets and are unable to cope as successfully with severe storms as the larger commercial craft. Upon the receipt of a storm warning or a weather forecast of unfavorable conditions, the small vessels can immediately make for harbor, which can be reached before the forecast warning period expires. Larger craft usually stay out unless the warnings are issued for very severe and wide spread storms.

These weather forecasts, warnings and advices are issued by the U. S. Weather Bureau and are telegraphed to the following stations to be broadcast as indicated:

Duluth, Minn., KFMS, 275 meters, 11:00 a. m.

Houghton, Mich., WWAO, 244 meters, 11:00 a. m. and 8:00 p. m.

Milwaukee, Wis., WHAD, 280 meters, 11:00 a. m. and 3:00 p. m.

Chicago, Ill., WGN, 370 meters, 9:00 a. m. and 10:45 p. m.

Chicago, Ill., KYW, 536 meters, 11:00 a.m. and 9:30 p. m.

Chicago, Ill., WAAF, 286 meters, 10:30 a. m. and 12:30 p. m.

Saginaw, Mich., WABM, 254 meters, 9:15 a. m.

Detroit, Mich., WWJ, 517 meters, 11:00 a. m.

Detroit, Mich., WCX, 517 meters, 1:50 p. m.

Cleveland, Ohio, WJAX, 390 meters, 9:40 a. m.

Buffalo, N. Y., WGR, 319 meters, 9:45 a. m. and 9:45 p. m.

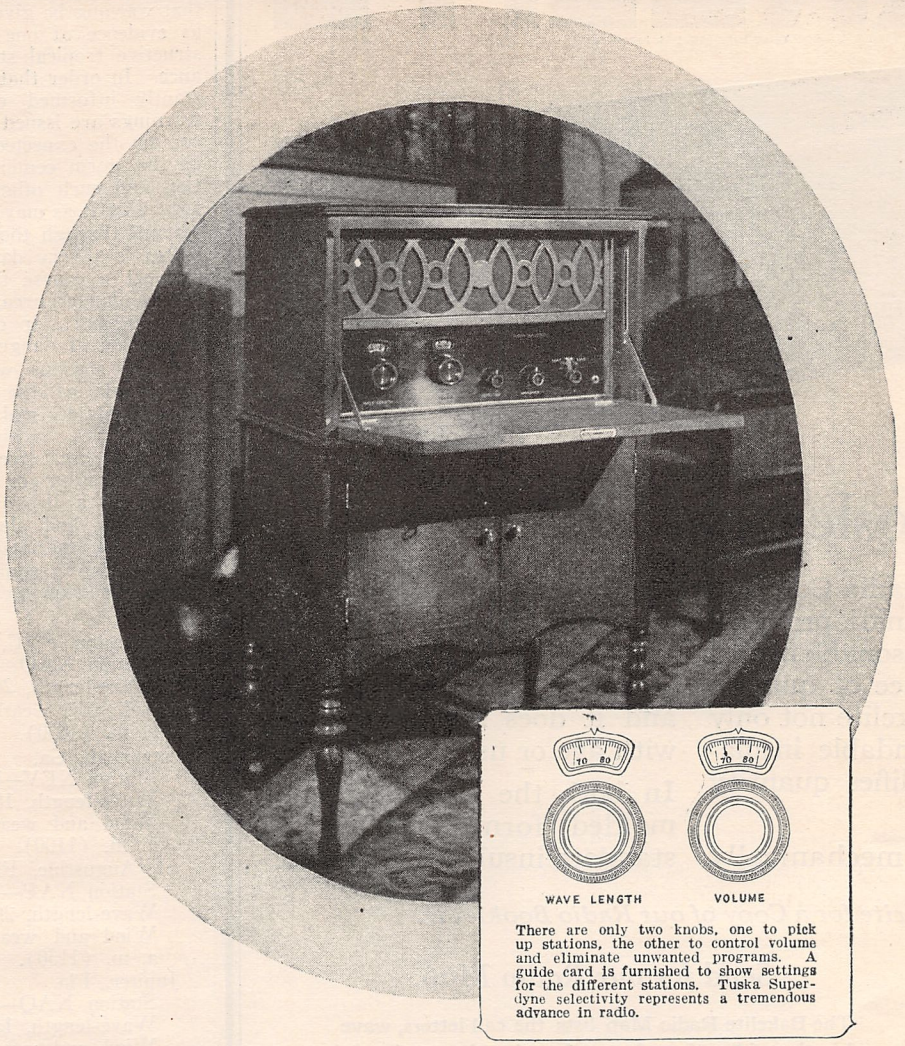
(Note: The time given above is reduced to 90th meridian or Central Time; add one hour to change to 75th meridian or Eastern Standard Time.)

RADIO NOW USED TO BROADCAST WEATHER FORECASTS INFORMATION

Storm and Hurricane Warnings for the Benefit of Navigation in Southern Waters.

Forecasts of wind and weather conditions issued by the United States Weather Bureau for the South Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, together with warnings of storms and hur-

TUSKA RADIO



There are only two knobs, one to pick up stations, the other to control volume and eliminate unwanted programs. A guide card is furnished to show settings for the different stations. Tuska Superdyne selectivity represents a tremendous advance in radio.

For Radio de luxe

LOOK over the radio programs for to-night and choose your entertainers. Turn to the two dials of the Tuska Superdyne—a quick adjustment, and lo! clear through the loud speaker comes the voice or music you have selected. Only natural conditions over which we have no control can prevent reception of the stations you want if you own the Tuska Superdyne.

Built by craftsmen, tested, retested, tried and proved under the personal direction of C. D. Tuska himself, each Tuska Superdyne gives the best results of which radio is capable. Tuska built receivers thirteen years ago, and you buy in Tuska receivers to-day the priceless heritage of this long experience in successful radio.

And handsome! Walnut finish, hand rubbed, gold mountings, and an array of smartly aristocratic designs are yours to select. All batteries may be concealed within the cabinet and only two external wires need be attached, for antenna and ground.

To get distant stations, fidelity in reproduction, easy operation, all in a radio set of de luxe design, buy the Tuska Superdyne.

THE C. D. TUSKA CO., Hartford, Conn.

Superdyne Extremely Selective

"I have found the new Superdyne to be extremely selective. On Saturday evening I tuned in the following stations at will, using a loud speaker:

WGY WHN WHAM WABC WIP WNYC WRC
WTAM WGN KDKA WNAC WNH WOR WMAL

Very truly yours,
(Signed) C. J. BECKER
Hartford, Conn."

TUSKA TRADE MARK REG. U.S. PAT. OFF. RADIO

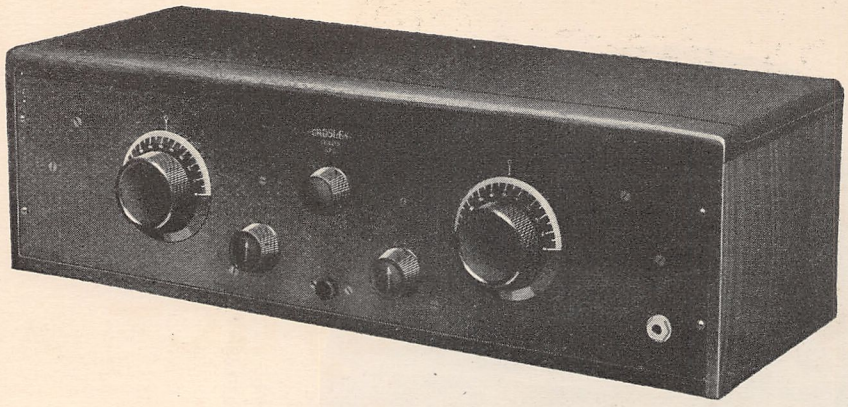
The Superdyne Radio Frequency Receiver

The model illustrated above is priced at $275 without tubes or batteries. Includes built-in horn—great for loud speaker reception of distant stations. Full, natural tone. Licensed under Armstrong Circuit Patent No. 1,113,149. Other Tuska receivers from $35 to $350.

Write for beautifully illustrated 30-page Catalog No. 11-P

BAKELITE

TRADE MARK REG. U. S. PAT. OFF.



Crosley *and* Bakelite

The Crosley Radio Corporation of Cincinnati produces radio sets at reasonable prices, with no sacrifice of quality. The use of Bakelite not only provides dependable insulation but simplifies quantity production.

Bakelite is mechanically strong, impervious to moisture and its color does not fade. Its properties are unaffected by climatic conditions and it does not deteriorate with age or use.

In both the laminated and molded form, Bakelite is standard insulation for radio.

Write for a Copy of our Radio Booklet B.

BAKELITE
Condensite
REDMANOL
are the registered Trade Marks for the Phenol Resin Products manufactured under patents owned by
BAKELITE CORPORATION

Send for our Radio Map

The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.

BAKELITE CORPORATION
247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22d Street

THE MATERIAL OF A THOUSAND USES

RADAK

RELIABLE RECEIVING SETS

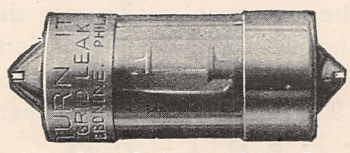
Licensed Under Armstrong Patent 1,113,149

BUILT BY AMERICA'S OLDEST MANUFACTURER

Clapp Eastham Co.
107 Main St. Cambridge, Mass.

Greater Distance. Less Noise

TURN-IT
ADJUSTABLE
GRID LEAK



Only $1 at Your Dealers, or Direct From Us.
TURN-IT RADIO SALES, Inc.
30 Church St., N. Y.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

ricanes when issued, are broadcast daily from a number of Naval and commercial radio stations within these areas.

The broadcasting service relative to hurricanes is very complete, as it is of the utmost importance that every available means of radio communication be utilized in order that warning be given instantly, just as soon as evidence of one of these swift and destructive tropical storms makes its appearance. In order that navigation be kept constantly informed concerning a hurricane, warnings are issued whenever advisable, and contain the expected direction of movement of the storm center together with its location and such other important information regarding it as may be necessary. Ships are warned through these broadcasts and if the storm is a very dangerous one, the vessels can set a course that will take them out of the danger area, seek immediate safety in some port, or delay their sailing until the period of danger is past.

Radio stations which are located along the coasts of the southern parts of the United States, and on the islands of the West Indies, receive these forecasts and warnings direct from the Weather Bureau at Washington for broadcasting. The following is a list of such stations making broadcasts and the time of distribution, using 75th meridian or Eastern Standard Time with its equivalent in 75th meridian civil Greenwich mean time (zone plus five time):

Charleston, S. C.
Station NAO—United States Navy.
Wave-length, 2607 meters, spark.
Wind and weather forecasts at 10:30 a. m. (1030).

Savannah, Ga.
Station NEV—United States Navy.
Wave-length, 1806 meters, spark.
Wind and weather forecasts at 11:00 a. m. (1100).

St. Augustine, Fla.
Station NAP—United States Navy.
Wave-length, 2098 meters, spark.
Wind and weather forecasts at 11:30 a. m. (1130).

Jupiter, Fla.
Station NAQ—United States Navy.
Wave-length, 1304 meters, spark.
Wind and weather forecasts at 11:30 a. m. (1130).

Key West, Fla.
Station NAR—United States Navy.
Wave-length, 5650 meters, CW; followed by 1460 meters, spark.
Complete meteorological bulletin broadcast at 10:00 p. m., (2200).

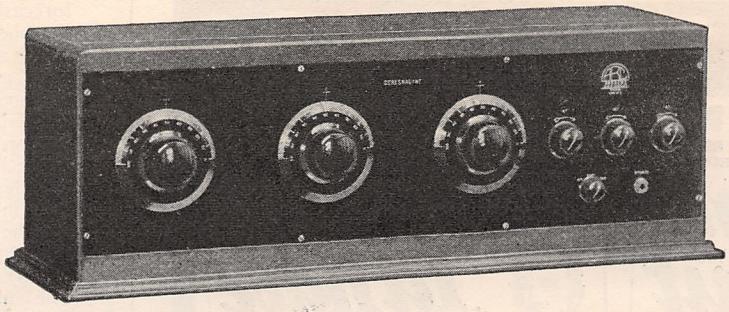
Pensacola, Fla.
Station NAS—United States Navy.
Wave-length, 1333 meters, spark.
Wind and weather forecasts at 11:45 a. m. (1145).

New Orleans, La.
Station NAT—United States Navy.
Wave-length, 2607 meters, spark.
Wind and weather forecasts broadcast at 11:00 a. m. (1100).
Forecasts for Texas, Louisiana, Oklahoma and Arkansas are broadcast at 10:30 a. m. (1030) and 11:00 p. m. (2200).

Port Arthur, Texas.
Station WPA—Gulf Refining Company.
Wave-length, 600 meters, spark.
Broadcasts a meteorological bulletin, and wind and weather forecasts for west Gulf of Mexico at 11:45 a. m. (1145).

Galveston, Texas.
Station NKB—United States Navy.
Wave-length, 1817 meters, spark.
Wind and weather forecasts broadcast at 11:30 a. m. (1130).

Brownsville, Texas.
Station NAY—United States Navy.
Wave-length, 4997 meters, CW.
Broadcasts a complete meterological bulletin of reports and wind and weather



And now the Andrews Deresnadyne–

successfully *combines* tone quality and selectivity with distance and volume

Hitherto it has been possible to purchase in a radio set one of two groups of qualities—tone and selectivity on the one hand, and distance and volume on the other—but not both. Now the Andrews Deresnadyne 5-tube Radio Receiving Set, using the new Deresnadyne *principle of the balanced plate circuit*, for the first time successfully combines the two. It secures the finest tone and high selectivity *with increased volume and distance.*

The tone quality of the Deresnadyne has never in our belief been equalled by any radio set on the market. It brings to the home for the first time a reproduction of music really comparable to the original. In volume the Deresnadyne will give anything from a mute tone to a volume that fills a large hall. It is highly selective. It will go through a powerful local station to reach a weak distant station with only a few meters difference in wave length. This selectivity is secured by the remarkably low resistance of specially designed transformers. It secures great distance by conserving signal strength through unusually close transformer coupling. The Deresnadyne circuit stops the oscillation which produces whistling and distortion in the plate circuit, before it reaches the grid, which is extremely sensitive and where all adjustments are very critical. It is the only circuit which stops oscillation at its source, where it can be easily and efficiently controlled.

The Deresnadyne is extremely simple in operation and construction. There is nothing to get out of order. It is easy to log. You can cut off all tubes or change from 4 tubes to 5 by simply turning the switch knob. A special feature is the Deresonator. This simple device enables you, by simply turning a knob, to accentuate either tone quality or distance as you wish. The set is handsome in appearance, with a case of solid, hand-rubbed mahogany.

Few sets have ever received the enthusiastic comments of radio authorities that have been given the Deresnadyne. Mr. Robert J. Casey, head of the Laboratory of the Chicago Daily News, sums up this opinion when he says: "*It has the quality of a crystal and the volume of a superdyne.*" Hear the Deresnadyne at your dealer's. If he does not carry it write to us.

DEALERS: *Order through your jobber.* JOBBERS: *Exclusive rights in open territory may be secured by aggressive jobbers of high standing.*

ANDREWS RADIO COMPANY · 327 S. LA SALLE STREET · CHICAGO

Andrews Deresnadyne

DĒ-RĔS'-NÀ-DĪNE · PATENTS PENDING

Radio Receiving Set

Price, without accessories

$150

WHERE THESE ADS ARE APPEARING—

You Can't "Blow" Out Your Tubes

Equip your Radio with a Protect-O-Tube Short-circuiting absolutely will not "blow" your tubes.

Money-back guarantee.

Nothing else like it on the market.

Tested and approved by Radio News Laboratories.

ONLY $1.35

NOT A FUSE

"I'd Have Saved $36 on Tubes"

—if I'd had a Protect-O-Tube," what one Radio fan said when he blew out every tube in his set making a new hookup.

Tested and approved by Radio News Laboratories.

$1.35 AT YOUR DEALER'S

NOT A FUSE

ACTUAL SIZE

he Don-Mac Co.
9 So. Desplaines St.
ept. 5 Chicago, Ill.

You Could Throw Steel Wool Into Your Radio

and not "blow" out one tube!

Short-circuiting *absolutely* will not "blow" your tubes when your set is equipped with a Protect-O-Tube.

Nothing else like it on the market.

Money-back Guarantee.

Tested and approved by Radio News Laboratories.

$1.35

NOT A FUSE

One protects your entire set.

AT YOUR DEALER'S

THE DON-MAC CO.
Dept. 5
29 S. Desplaines St.
Chicago, Ill.

you can be sure of obtaining a Protect-O-Tube at your local dealer's

If your dealer has not yet stocked Protect-O-Tube have him order for you and we will send it immediately.

JOBBERS AND DEALERS: Write or wire us regarding supplies of the fast-selling Protect-O-Tube to take care of your trade. Extremely attractive sales proposition. Protect-O-Tubes come grouped on handsome display cards, all ready for hanging. Advertising campaign in big mediums now scheduled.

THE DON-MAC COMPANY
Dept. 10, 29 S. Desplaines St., Chicago, Ill.

FREE YOUR OWN Name and Address Printed on Thank You Cards

Hear what YOU like. Stations are glad to put on numbers at your request. We print Special Cards that get ATTENTION. All the RAGE. Cards (Printing FREE) 100—only $1.35; 200—$1.85; 300—$2.35, POST PAID. Order TODAY.

MONEY REFUNDED if Not Satisfied

High grade printing—Good quality cards—You will be DELIGHTED.

Send order with check or money order today — NOW.

RADIO PRINTERS, 20 Main Street, Mendota, Illinois

"Lighting Fixtures"
READY TO HANG
(Direct from Manufacturer)
Completely wired including glassware.
Send for Catalogue No. 26.
(Just off the Press)
Special Proposition to Dealers
ERIE FIXTURE SUPPLY CO.
STATION R ERIE, PA.

HUDSON-ROSS
Wholesale radio only.
One of the first and still in the lead.
Write for discounts.
123 W. Madison St. Chicago

RADIO PARTS and SCREW MACHINE PRODUCTS to your Specifications—Send Blueprints or Samples for Quotation

THE NEWTON MFG. CO.
125 Main Street, Plainville, Conn.

Get a Handy Binder for your RADIO NEWS. Holds and preserves six issues, each of which can be inserted or removed at will. Price 65c Experimenter Pub. Co., Inc., Book Dept., 53 Park Place, N. Y.

forecasts for the Gulf of Mexico and Caribbean Sea at 12 midnight (0000). Wind and weather forecasts for Texas coast are broadcast at 12 noon (1200) on wave-length of 2255 meters, spark.

Swan Island, W. I.
Station US—United Fruit Company.
Wave-length, 2240 meters, spark.
Broadcasts a complete meterological bulletin and wind and weather forecasts for the Gulf of Mexico and Caribbean Sea (latest information) at 12:30 p. m. (1230) and 11:45 p. m. (2345).
The information which is broadcast from this station is transmitted from station WNU of the Tropical Radio Co., at New Orleans, on a wave-length of 3331 meters, CW, at 11:30 a. m. (1130), and 11:30 p. m. (2330). These messages may be picked up by any ship and used or repeated, if so desired, by approval of the Tropical Radio Company and the United States Weather Bureau.

San Juan, P. R.
Station NAU—United States Navy.
Wave-lengths, 4836 meters, CW, first transmission at 7:45 p. m. (1945), and 2855 meters, spark, at second transmission, at 9:00 p. m. (2100).
Broadcasts complete meteorological bulletin and wind and weather forecasts for Porto Rico and vicinity.

San Juan, P. R. (Continued).
Station WKAQ—Radio Corporation of Porto Rico.
Wave-length, 360 meters, radiophone.
This station repeats the bulletin broadcast by NAU at San Juan, by radiophone, in both English and Spanish, at 9:00 p. m. (2100). Storm and hurricane warnings and advices when issued.

Guantanamo, Cuba.
Station NAW—United States Navy.
Wave-length, 4543 meters, CW.
Broadcasts a complete meteorological bulletin (same as that broadcast from NAU at San Juan), at 9:00 p. m. (2100).

Hurricane warnings and advices are broadcast from all of the above stations whenever issued, and at two hour intervals until midnight.

Hurricane warnings are broadcast whenever issued and repeated at four hour intervals until midnight from the following:

Guantanamo, Cuba.
Station NAW—United States Navy.
Wave-length, 1395 meters, spark.

Port au Prince, Haiti.
Station NSC—United States Navy.
Wave-length, 2255 meters, spark.

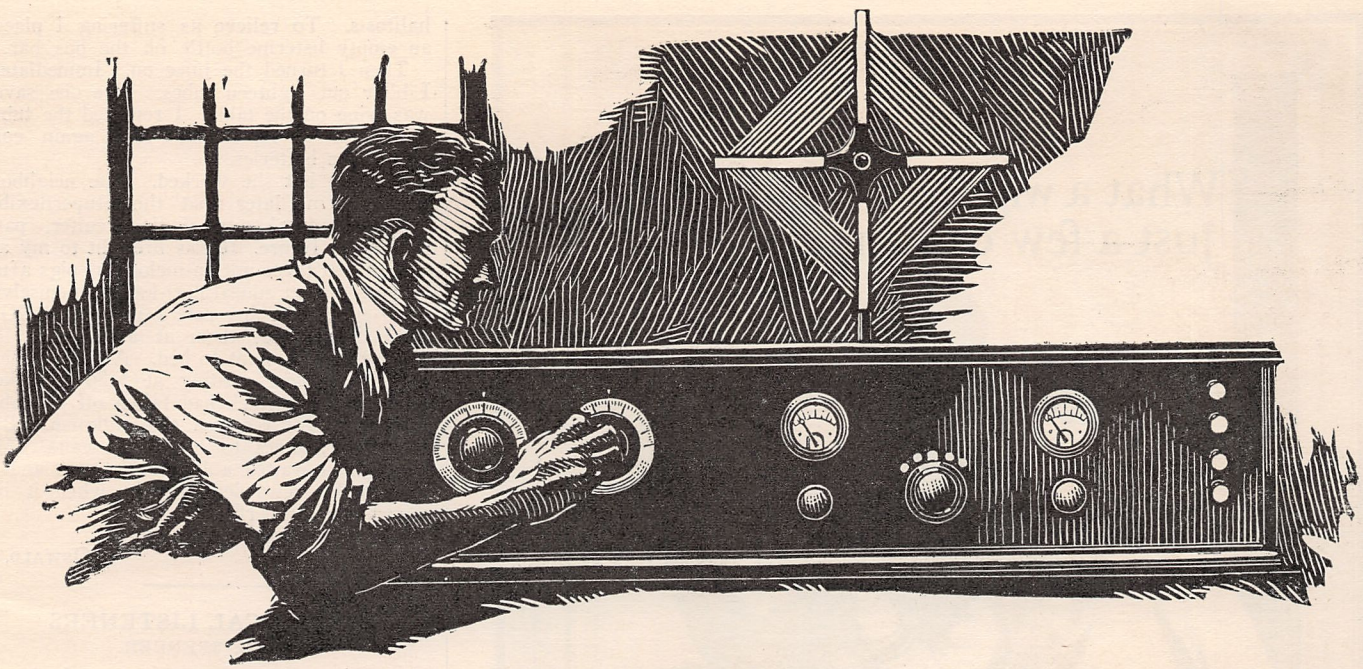
St. Thomas, V. I.
Station NBB—United States Navy.
Wave-length, 1685 meters, spark.

St. Croix, V. I.
Station NNI—United States Navy.
Wave-length, 425 meters, spark.

Radio Humor

(*Continued from page* 704)

nothing. The noise reminded me of a Ku Klux meeting in a Texas cemetery receiving the results of a gubernatorial election. I investigated and discovered the wherefore and whyfore of all this silence. The tubes weren't lit up. A little wood alcohol poured on each plate overcame this difficulty—that alcohol would have lit up the Washington Monument. Still the phones kept a disgusting silence. More investigation and the trouble was revealed. A peculiar odor somewhat like Friday in a fish market full of untuned tuna fish was emanating from the spaghetti. I called in the proprietor of the Italian restaurant on the corner and he tasted the spaghetti. As they were carrying him to the ambulance he managed to tell me that the insulation was suffering from



Mechanical Quality and Insulation Value!

THE mechanical qualities of Formica have as much to do with the preference of the 125 leading independent radio manufacturers for Formica, as its high dielectric strength.

These makers want to know that their panels are not going to sag and curl, and that the screws and binding posts will not loosen up because the material is so elastic it flows out under pressure.

They build for permanence. They want fine finish — and lasting finish. They want a material that will work well in their factories. And they get it all in Formica!

This year there will be scores of sets that carry a Formica front panel, Formica base panel, Formica terminal strips, Formica transformer cases, Formica jack washers — and many other parts. That stops losses and gets more distance and volume.

Be sure to use a Formica base panel in your Neutrodyne or Super-hetrodyne.

Dealers: The standing of Formica as radio insulation is well known by most amateurs and they want it. It is a satisfactory line that moves in good volume.

THE FORMICA INSULATION COMPANY
4618 Spring Grove Avenue, Cincinnati, Ohio

Sales Offices

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415 Ohio Bldg., Toledo, Ohio
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516 Caxton Bldg., Cleveland, Ohio
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APPROVED RADIO NEWS LABORATORIES 1923

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

halitosis. To relieve its suffering I placed an empty listerine bottle on the bus bar.

Then I turned the juice on. Immediately I blew out eighteen tubes. The one saved was lying on the table. I replaced the tubes with electric light bulbs and again connected the batteries.

Oh boy, but she worked. The neighbors informed me later that the Stuperflexible could outsqueal any single-circuiter, past, present or future. It was brought to my attention that three not un-melodious pigs after hearing my set squeal hari-karied themselves from envy. At any rate I picked up KGO at 3:37 and lost them at 3:39 when the man next-door went to bed. After a period of long, patient waiting at 5:26 I picked up the phones which had fallen off the table and at 5:41 I received the milkman. But everything comes to him who waits. My ashcan had waited a long long time and it was finally rewarded at 6:13 when it received the Stuperflexible.

Sincerely signing off,

OSWALD.

OUR LOCAL LISTENERS

By L. SPENCER

(A serious subject made the more effective by the introduction of humor.)

The question of whether broadcasters and broadcasting is appreciated is in the main, answered. Every broadcast station can show with pride thousands of letters from radio fans all over the country.

But, what do the local fans think of their station? Ask any studio manager and his answer will surprise you, "Verily a prophet is without honor in his own country!"

The writer, through the friendship of a studio manager, succeeded in getting first hand information on this interesting subject. The studio manager appointed us telephone operator for a night, impressing us with the fact that we would be representing the station and, therefore, must be as courteous as a politician three days before election day, when dealing with the fans.

We were immediately carried on the wings of imagination to the position of a benevolent benefactor to the world at large; we thought of how we were comforting the sick, bringing beautiful music into the homes of those who had never before had the pleasure of real good music, etc., etc. Alas for such anticipation of the grateful public!

The program for the evening had been advertised in all local papers for a week previous, giving full details as to artists, time, and name of the selections to be rendered. There were bedtime stories from 7 until 7:30, followed by an hour of classical music, an intermission of half an hour and dance selections by a jazz band. The zero hour approached and we began to feel somewhat excited by the prospects that our imagination had supplied, taking our place at the switchboard with a radio receiving set by our side equipped with head phones, we anxiously awaited the opening announcement and our first call.

Brr, Halloo iss 'at station O. G. B.?"

Using our most dulcet tones we informed the speaker that it was.

"Say what time ya on?"

Ha, we thought, this poor mortal cannot read. So very gently we replied, "Seven o'clock until ten."

"All right, I just wanted to make sure." CLICK (hung up).

Brrr, "Halloo iss 'at station O.G.B.?"

What? surely not another, once again, but not quite so sweetly, "Seven until ten."

"All right, I just wanted to know."

At this we began to think that perhaps the newspapers had omitted our program. Seizing the evening edition we hastily scanned the Radio Program column, and with a sigh of relief we read, "Station O.G.B. Transmits Varied Program To-

YOU CAN GET EVERYTHING YOU WANT WITH THIS SET

LEMCO EQUIPMENT No. 340 Crystal Receiver

$6.00 Delivered

provides clear, distinct, loud reception of both voice and music within 50 mile radius. Thousands in use attest their popularity.

LEMCO RADIO PARTS

offer more real value for the money than any made. Note the low prices.

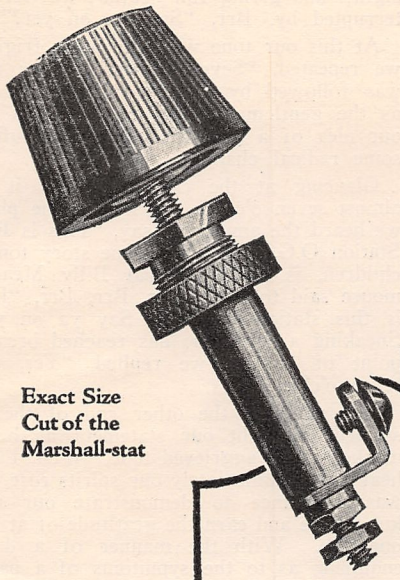
No. 250 Reflex Coils $2.00	No. 100 Broadcast Tuner ..$5.00
No. 275 Reflex Units, with 17-plate condensers 8.00	No. 340-B Crystal Receiver 6.00
No. 300 Fixed Crystal ..... .60	No. 55 Knockdown kit (2-tube Harkness reflex ..25.00
No. 401 Audio Transformer.. 3.50	No. 50 Neutroflex Receiver 50.00

If your dealer can't supply you—send direct. We'll deliver C. O. D. anywhere.

LEE ELECTRIC & MFG. CO.

220 EIGHTH STREET SAN FRANCISCO, CALIF.

Write for Booklet R-81



Exact Size Cut of the Marshall-stat

Marshall-stat

Do You Want to Hear More Stations?

Getting more stations with the equipment which you have is largely a matter of adjustment on your tubes.

Then why not use the smoothest accurate-adjustment rheostat you can get—the Marshall-stat?

You will find in the Marshall-stat a means of obtaining any desired adjustment with absolute precision. The Marshall-stat varies the resistance, not step by step, but smoothly, continuously, and uninterruptedly from zero to maximum.

The Marshall-stat provides vernier precision throughout its entire range. Yet, there is only one knob to manipulate—no troublesome double adjustment to make.

It brings new stations to your receiving set and clears up for you the stations which you hear only occasionally and at those times indistinctly.

Without having to drill additional holes, any one can install Marshall-stats in his receiving set, whether it is home-made or factory made. And wherever Marshall-stats are used, the pleasure and fun of radio are enormously increased.

ADVANTAGES of the Marshall-Stat

Requires only one hole in panel. Can be inserted in hole from which old rheostat is removed.

Vernier all the way—but only one adjustment to make.

Only two terminals. Connections cannot be made incorrectly.

Can be used with any tube or combination of tubes.

Compact in size. (Note full size cut above). Takes up very little space. Can be fitted anywhere.

Working parts entirely enclosed in nickel-plated chamber.

Knob can be replaced with the knob of your set. Only one special screw (furnished at nominal extra charge) needed to make change.

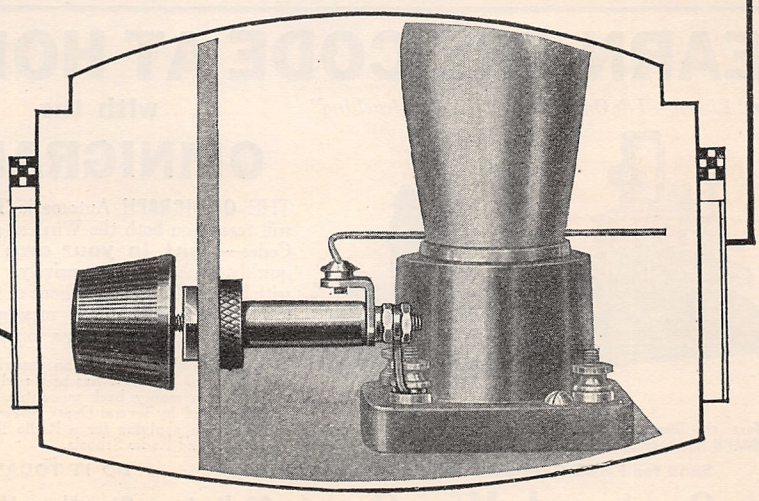
Discs made of specially-treated material which is the result of years of experimental and research work by radio and electrical engineers. Are absolutely uniform throughout.

Mechanical construction and proportions of discs are such that breakage is impossible.

Price $1.75

MARSHALL ELECTRIC COMPANY

3235 Locust Boulevard **Saint Louis, Missouri**



Send for Old Man Ohm's descriptive folder on the Marshall-stat.

THE IDEAL RHEOSTAT FOR ALL TUBES

What a Difference:

ARE you having trouble with your set—is your reception ruined by distortion, by "frying" noises—can you get only local stations?

Do these two simple things. Replace your present grid leak with an Electrad Certified Leak of the proper resistance, and put an Electrad Audiohm across the secondary of your audio transformer.

Stations you never before heard will come in loud and clear as a bell. Crackling, frying sounds will disappear as if by magic.

Electrad parts are on sale by most all good radio dealers. If your dealer cannot supply you order direct, giving name of your local dealer. Certified Grid Leak, 50c. Audiohm, $1.50.

ELECTRAD, Inc., Dept. H.
428 Broadway, New York

MAKERS OF
Hydrogrounds, Glass Grid Leaks, Variable Grid Leak and Condenser Combined, Grid Leak Mountings, Lightning Arresters, Aerial Outfits, Fixed Resistance Units, Indorarial, Lamp Socket Antenna, Variohm, Lead-In, Resistance Coupled Amplifier Kits, Verni Tuner.

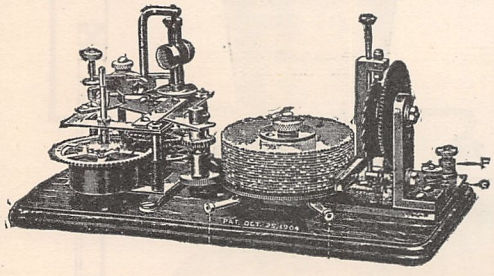
ELECTRAD INC.

LEARN THE CODE AT HOME

"Just Listen—The Omnigraph will do the teaching"

with the

OMNIGRAPH



THE **OMNIGRAPH** Automatic Transmitter will teach you both the Wireless and Morse Codes—**right in your own home**—quickly, easily and inexpensively. Connected with Buzzer. Buzzer and Phone or to Sounder, it will send you unlimited messages, at any speed, from 5 to 50 words a minute.

THE **OMNIGRAPH** is not an experiment. For more than 15 years, it has been sold all over the world with a money back guarantee. The **OMNIGRAPH** is used by several Depts. of the U. S. Govt.—in fact, the Dept. of Commerce uses the **OMNIGRAPH** to test all applicants applying for a Radio license. The **OMNIGRAPH** has been successfully adopted by the leading Universities, Colleges and Radio Schools.

Send for FREE Catalog describing three models. **DO IT TODAY.**

The Omnigraph Mfg. Co., 20 Hudson St., New York City

If you own a Radio Phone set and don't know the code—you are missing most of the fun

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

night," and giving full details; we were interrupted by, Brr, "Say ya on yet?"

At this our tone was somewhat frigid as we repeated, "Seven till ten." Our reply was followed by an ear-splitting CLICK as the gentleman hung up. By this time our idea of a grateful public had suffered some radical changes.

Glancing at the clock we saw it was almost seven o'clock, putting on the phones we heard the announcer say, "This is Radio Station O.G.B. Our bedtime story tonight, children, is entitled What Billy Meadowmouse said to——" Brr, Brr, Brr, "Hallo is this station O.G.B.? Say ya on yet?" Speaking as one who has reached breaking point of temper, we replied, "Yes, since seven o'clock."

The party at the other end of the line seemed to doubt our statement as he remarked in an aggrieved tone, "Well, I can't hear ya." Immediately our spirits rose, here was a chance to demonstrate our radio knowledge and earn the gratitude of at least one fan. With the manner of a doctor enquiring as to the sypmtoms of a patient we asked, "What kind of a set have you got?"

The fan at once launched into a detailed description of how he became interested in radio. His brother-in-law who knew a man that once knew an operator on a steamer got the directions to build a "Radio" direct from the aforementioned gentleman, he said. This would never do, we puzzled our brain to think of some method to stem this rapid flow of words. Finally,

"What seems to be wrong with your set?"

"Well, I can hear you, but not as loud as usual."

Smothering a groan we suggested he look over his batteries, and call us later, and to ourselves we added, "Very much later." By this time the classical portion of the program was being given and we managed to hear a few bars. But the telephone buzzer sounded once more, "Is 'at O.G.B.? Why do you force that highbrow stuff on us, why don't ya play 'Last Night on the Front Stoop'?" Oh, Death, where is thy sting?—is this the grateful public that the radio is educating to the better things in life, but we answer, stifling our personal feeling, with:

"I'm sorry you don't care for the program, but there will be dance music later on."

Then—

Brr, Brr, "Hallo, say will you please ask the man next door to us to stop playing his Victrola, we can't hear a thing on our radio? His number is Bozo 4235."

After explaining that we had no control over the man next door the party hung up, but in a nasty manner said, "All right, if ya don't want us to listen to your old concert, we won't, see." CLICK.

By this time we were wondering if there were anybody in the whole city who liked our efforts. We were also getting afraid to answer the phone at all, our head ached, our tongue was dry, we were completely disillusioned, we—— Brr, Brr, "Is 'at O.G.B., well listen here, you're rotten, what's the matter with ya, I get a squeal in the music every once in a while, why the dash dash don't you leave it alone when its all right?"

We tried to explain that, most likely, in his vicinity a set was oscillating and causing this effect, but——

"Nothing of the kind, say, what do ya think I am? Say, I built this set myself, I know what I'm talking about, it's your rotten station." CLICK. This was, we thought, the last straw. A couple more calls like that and we would leave for parts unknown, the ungratefulness, the egotistical attitude of the public as a whole filled us with hate, the——

Another step ahead!

ULTRADYNE

The Improved

SUPER-HETERODYNE

MODEL L-2

"Modulation System"-Plus Regeneration

THE new Ultradyne, Model L-2 surpasses all conceptions of sensitivity and selectivity—represents the peak of Super-Heterodyne engineering skill.

To the "Modulation System" which has previously made the Ultradyne famous, regeneration is added in Model L-2. The result is ultra-sensitivity, never before thought possible. Oscillations can be controlled and infinitely weak signals regenerated and heterodyned through the radio frequency amplifier.

Selectivity is so high and amplification so strong that distant stations can be tuned in through local stations and put on the loud speaker.

This use of regeneration is the latest development of R. E. Lacault, A.M.I.R.E., Consulting Engineer of this Company, and formerly Radio Research Engineer with the French Signal Corps Laboratories, since his perfection of the "Modulation System" which is used exclusively in the Ultradyne Receiver.

The Model L-2 Ultradyne compels so complete a revolution in all previous ideas of Super-Heterodyne performance, that you can only comprehend its unusual selectivity, sensitivity, volume and range by operating this wonderful receiver.

Write for descriptive circular.

PHENIX RADIO CORP., 3-7 Beekman St., New York

Send for 32-page illustrated book giving latest authentic information on drilling, wiring, assembling, and tuning the Model L-2 Ultradyne Receiver.

50c

Ultradyne Kit

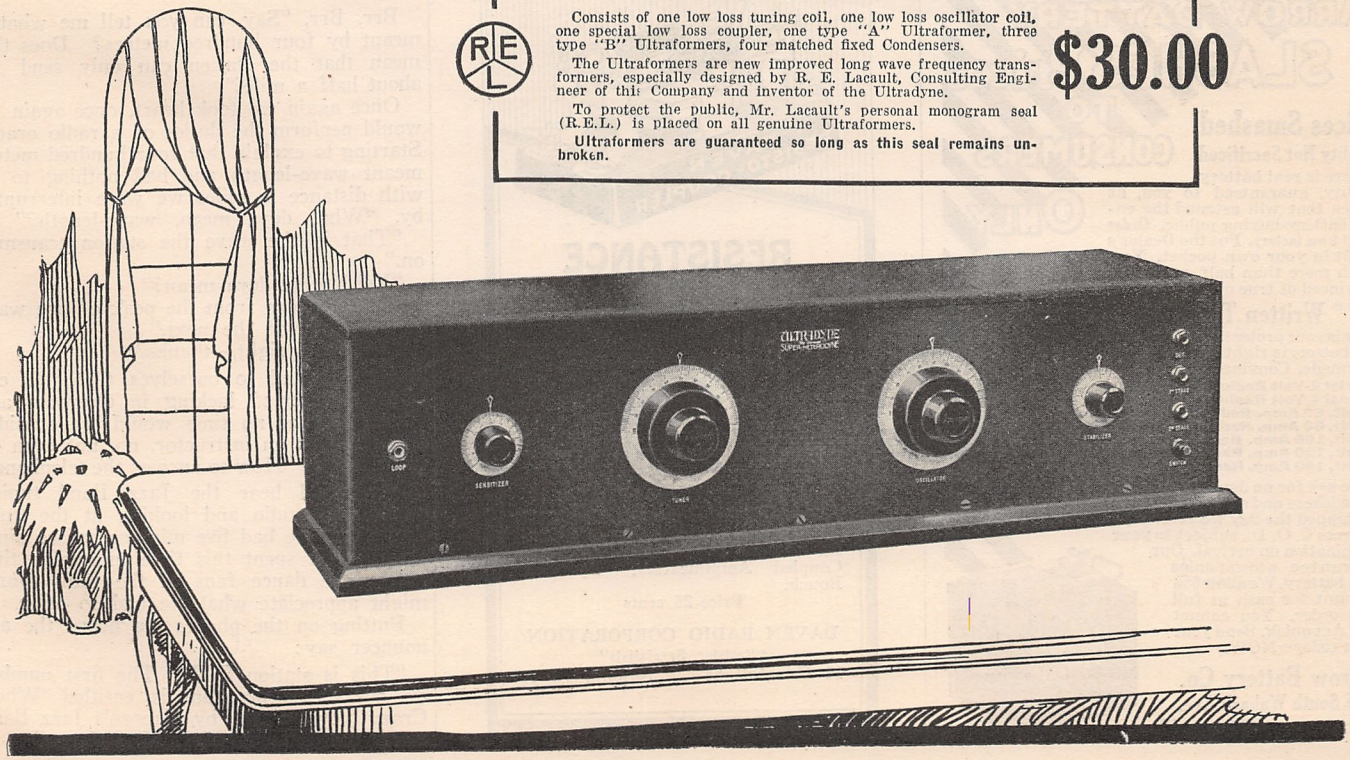
Consists of one low loss tuning coil, one low loss oscillator coil, one special low loss coupler, one type "A" Ultraformer, three type "B" Ultraformers, four matched fixed Condensers.

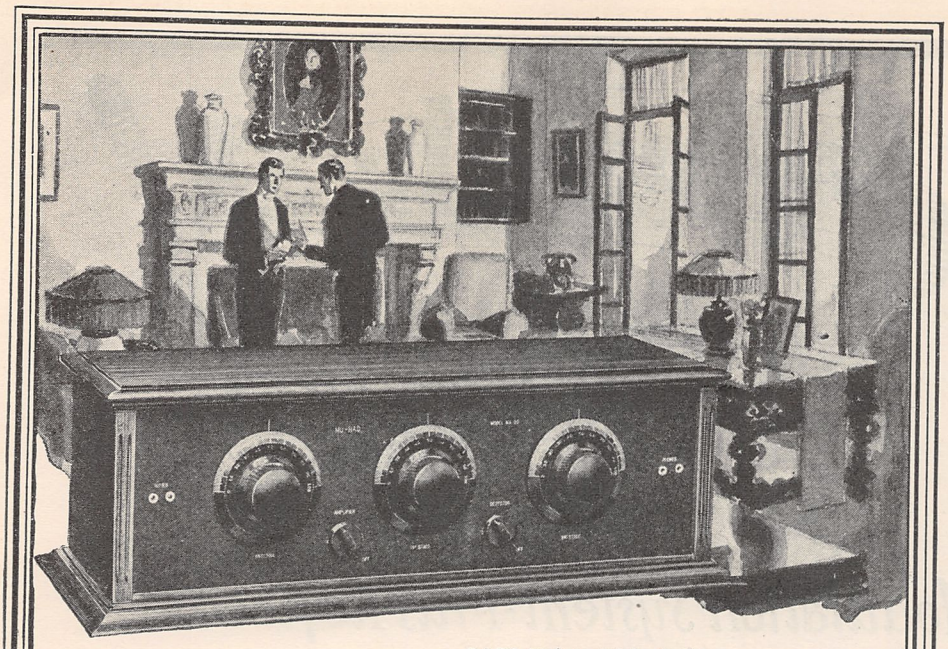
The Ultraformers are new improved long wave frequency transformers, especially designed by R. E. Lacault, Consulting Engineer of this Company and inventor of the Ultradyne.

To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on all genuine Ultraformers.

Ultraformers are guaranteed so long as this seal remains unbroken.

$30.00





MU-RAD MA 20

Turn your switch and get Cuba or Seattle

It is no trouble at all for a person in Dallas, Texas to pick up either Seattle or Cuba with a Mu-Rad MA-20! Mr. K. H. Wiggett in Sherbrooke, Quebec got Los Angeles and "heard them perfectly."

The amazing thing is, the Mu-Rad MA-20 does this without any batteries. Just hook it up to your electric light socket and you are in touch with the continent.

The Mu-Rad is so easy to operate! It will select stations with such rare delicacy that even a person with no knowledge of radio whatever may get any desired program that is in the air quickly and easily.

As for tone quality, the Mu-Rad must be heard to be believed. Get prepared for the Christmas programs. Write for literature on Mu-Rad receivers and proof of the amazing results owners get.

MU-RAD
LABORATORIES, INC.
Asbury Park, New Jersey

ARROW BATTERY SLASHES Prices TO CONSUMERS ONLY

Prices Smashed!
Quality Not Sacrificed

Here is real battery quality, guaranteed to you, at prices that will astound the entire battery-buying public. **Order direct from factory.** Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a **Written Two-Year Guarantee**

Here is your protection! No need to take a chance. Our battery is right—and the price is the lowest ever made. Convince yourself. Read the prices!

Special 2-Volt Radio Storage Battery, $3.75
Special 4-Volt Radio Storage Battery, 6.00
6-Volt, 60 Amp. Radio Storage Battery, 7.00
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6-Volt, 120 Amp. Radio Storage Battery, 11.50
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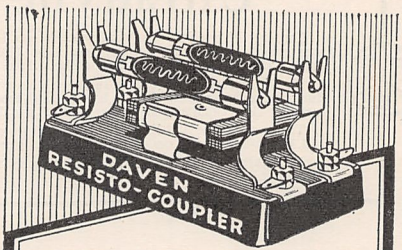
We ask for no deposit. Simply send name and address and style wanted. Battery will be shipped the day we receive your order Express C. O. D., subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Act quick. Send your order today—NOW.

Arrow Battery Co.
1215 South Wabash Ave.
Dept. 6 Chicago, Ill.



RESISTANCE COUPLED AMPLIFICATION

The tone quality from a *Daven Resistance Coupled Amplifier* is the most perfect known to the radio art.

The *Daven Resisto-Coupler*, illustrated, greatly simplifies the construction in building up one of these distortionless amplifiers.

Sold everywhere—$1.25

Ask your Dealer for the "DAVEN RESISTOR MANUAL"—a practical hand book on Resistance Coupled Amplification. By Zeh Bouck.

Price 25 cents

DAVEN RADIO CORPORATION
"Resistor Specialists"
11 Campbell St., Newark, N. J.

Brr, Brr, "Oh, is this station OGB? Well, I just called to tell you how much I am enjoying your concert, and would you please ask Miss D. S. O'Prano to repeat her number?"

Would we? Would we? We would ask the entire company to repeat every number several times if we got three calls like that.

We suffered a slight change of heart after this. Maybe we were hasty to judge the entire audience by a few, and no doubt we—— Brr, Brr, Brr, "Say, ya on yet?"

It is ever thus, "YES, seven till ten."

Hoping that we might get another encouring call we held the telephone expectantly, knowing the first part of the program was nearing the end.

Brr, Brr, Brr, "Say, when a ya gointa give us some real Jazz? I'm sick a all these Eyetalian guys' music."

In a ten below zero tone we answered, "At nine thirty."

We put on the radio phones in desperation just in time to hear the announcer say, "We are now standing by until nine o'clock when the dance portion of our program begins."

Now, we thought, we shall enjoy a short rest. But no, decidedly no.

Brr, Brr, "Say, ya on yet?"

"Not until nine thirty."

"What's on the program?"

"Dance music by Kabozo's Jazz Hounds."

"Aw gee, I don't wanta hear no darn Jazz, why don't ya give us some opera sometimes?"

Explaining very gently that we had just concluded the classical portion of our program the speaker continued,

"Well, why don't you put it in the papers?"

"It was published in full, in tonight's edition of the 'Bugle.'"

"Well, I didn't see it." CLICK.

Before we had time to think again——

Brr, Brr, "Hallo, is that station OGB? Could you please tell me what station JOG (a small station about 1,000 miles from our city) is transmitting tonight?"

No, we could not, we advised looking in the radio section of some of the papers, but received as an answer:

"Gosh, don't you know anything?" CLICK.

What we thought of the radio public cannot be written, it was impossible to attempt to——

Brr, Brr, "Say, can you tell me what is meant by four hundred meters? Does that mean that the station can only send for about half a mile?"

Once again we took heart, once again we would perform the duties of a radio oracle. Starting to explain that four hundred meters meant wave-length and had nothing to do with distance in miles we were interrupted by, "What deya mean, wave-length?"

"That is the wave the station transmits on."

"Yeh? what deya mean?"

"The distance from the peak of one wave to the peak of the next."

"Yeh? All right,—thanks."

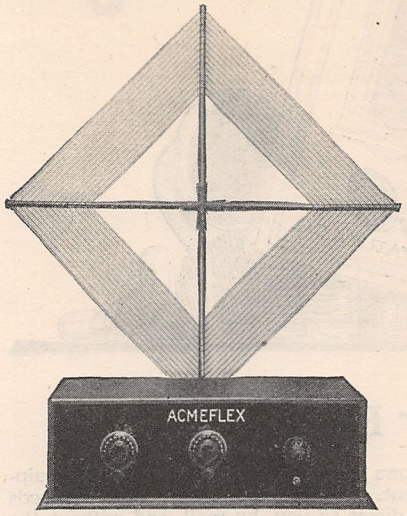
We admitted to ourselves that this explanation seemed lacking in clearness and vowed that at no time would we consider a position as an instructor, no, not even an instructor of "How to answer the telephone."

We could hear the Jazz Band tuning up in the studio and looking at the time, found that we had five minutes before nine-thirty. We spent this time in hoping that maybe the dance fans of the radio world might appreciate what we had to offer.

Putting on the phones we heard the announcer say:

"This is station OGB. The first number on our dance program is entitled 'Who's Crazy Now,' played by Kabozo's Jazz Band under the direction of I. M. Kabozo."

Turn your spare time into money
by assembling ACMEFLEX KITSETS



A set that you can put together

MILLIONS of radio sets will be purchased this year. Many of them will go into the homes of your neighbors.

There are lots of people who would like to have a radio set but haven't the time or think they don't know how to build one. Look around your neighborhood and you'll find them, a busy business man who would have a radio set if he could find someone to build it, or perhaps a lady without men folks to help, and to whom radio seems mysterious but very desirable.

The Acmeflex Kitset model S has all the necessary parts except tubes, batteries, loud speaker and cabinet to make a complete set as good as anyone's.

It uses the famous **Acme Reflex circuit.**

Only one tuning dial, everything on a loop and loud speaker.

Only two tools are required to put it together and they're in the kit. Complete instructions, no soldering to do, no workshop or technical knowledge is required. We have done everything but assemble the set.

Make one yourself so you can demonstrate it.

Write to Acme for more information. Address Dept. 70.

ACME APPARATUS COMPANY
Transformer and Radio Engineers and Manufacturers
Dept. 70, Cambridge, Mass

ACME ~for amplification

Ward's Radio Catalogue

Write for your FREE *copy*

We want you to have a copy of Ward's new Radio Catalogue.

You will find it a storehouse of information — a dependable guide to the newest and most important radio developments.

It shows all improved parts and diagrams of the best hook-ups for the man or boy to build his own set, as well as the very best ready-built sets at surprisingly low prices.

Montgomery Ward & Co. are Headquarters for *everything* in Radio. And this Catalogue shows complete everything in Radio equipment. Remember we sell only standard goods — direct to you by mail, and without the usual Radio profits.

For 52 years, "Satisfaction guaranteed or your money back," has stood behind every Ward sale. At Ward's, quality is never sacrificed to make a low price.

Write for your copy of this 68-page Radio Catalogue. See for yourself the low prices. You may as well profit by the savings it offers.

Address our house nearest you: Dept. 2-R

ESTABLISHED 1872

Montgomery Ward & Co.

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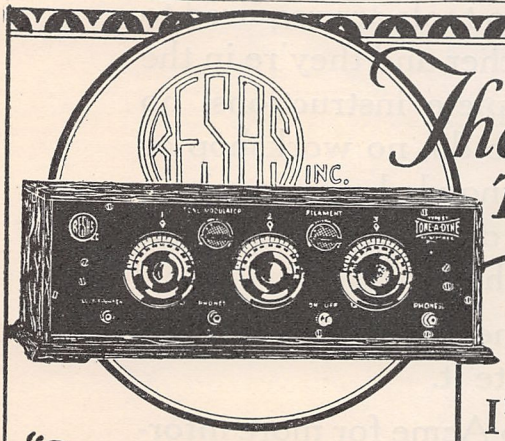
Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Ft. Worth



The RESAS TONE-A-DYNE

"The set with the Tone Modulator"

$78

A Very Powerful 5 TUBE SET

IF you are a lover of music perfectly reproduced then you have been waiting for the RESAS TONE-A-DYNE, the *only* set built with a Tone Modulator, which enables you to vary the tone strength to suit your tastes.

No longer is it necessary to listen to a blaring loudspeaker.

Every TONE-A-DYNE carries a one year guarantee.

Write for interesting Booklet R.B. If your dealer is unable to supply you write us direct.

Dealers—Interesting Proposition.

RESAS INC.
112 Chambers St., N.Y.C.

Insure your copy reaching you each month. Subscribe to Radio News—$2.50 a year.
Experimenter Publishing Co., 53 Park Place, N. Y. C.

We told ourselves sympathetically that we were rapidly approaching the crazy stage.

We listened to the jazz for a short time, a very short time, for——

Brr, Brr, "Would you please ask the Jazz Band to play, 'We are all out of Strawberries'?"

We would, and at the same time asked, "How was it coming through?"

"The music is fine, you won't forget to ask them, will you?"

We assured them we would not.

Brr, Brr, "Say, when are you signing off?"

"About ten o'clock."

"Is that so, well, let me tell you that the horrible noise you are transmitting annoys me greatly, and Station XYZ is transmitting a wonderful lecture on 'Why you should be kind to June Bugs,' and I can hardly hear a word the lecturer says, so just shut off that row until he's finished."

We tried to tell this lady that we had our regular schedule and must keep to it and that there were other people who cared for music more than June Bugs. This explanation only poured oil on the flames of her wrath, "Well, listen here, young man, let me tell you that I think that you and your station are a disgrace to the city." CLICK.

Oh, if we could only meet that lady face to face, what we'd say to her, to think that a lecture on June Bugs——

Brr, Brr, "Hallo, your concert is just lovely, ask the orchestra to play their last number again, will you?"

By this time we had reached a state of bored indifference, so we answered wearily, "We will, thank you."

How many years had we sat at this switchboard? It seemed it must have been some time in the dim past when in all our youth and innocence we had thought of the wonderful time we were going to have.

Brr, Brr, Brr, went the telephone. Should we answer it? We picked up the receiver anyway.

"Hallo, is that OGB? Gee, that's great jazz you're giving us tonight, do you think they'd play 'Home Again' as an encore?"

We thought they might and thanked the fan.

We were longing for the magic words, "Signing Off," as much as the woman of the June Bugs. Another ten minutes and we would be free. Putting on the radio phones we listened to the last number and soon afterwards the welcome words, "Signing Off. Good-night." We staggered away from the switchboard and, as the raven, we quoth, *never more.*

Remember that radio is not entirely electrical and that there are humans who are doing their best for your entertainment. If you don't care for the program don't kick. There are others who do and you can always shut off your set and go to bed, the broadcasters can't.

LONG MAY THE WAVE WAVE

RADIO INSTRUCTOR: "What is the aerial for?"

STUDENT: "To let people know you have a radio set."

RADIO INSTRUCTOR: "What is a loud speaker for?"

STUDENT: "To keep the family awake."

RADIO INSTRUCTOR: "What are the phones for?"

STUDENT: "To flatten one's ears."—*Marvin Schmidt.*

LITZ ADMIT IT

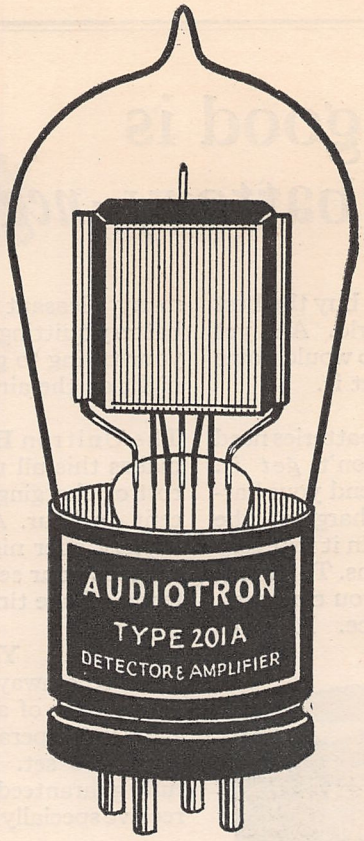
"What kind of wire is always in the aerial of a wrecked ship?"

"Dunno, Om."

"It's stranded, my boy, stranded."—*Jack Bront.*

APEX AUDIOTRONS

The Tube with Three Years of Successful Service to the Radio Industry



PRICE $4.00

"Sound Perfection" as is always built into the APEX tube is the reason why they have outlasted so many other tubes on the market three years ago and today still rank with the very finest the market affords.

That we have thousands of satisfied users in every corner of the United States who use only Apex Audiotrons is reason enough to prove that they can always be depended upon to give ample volume, clear tone and long service.

APEX AUDIOTRON GUARANTEE

All Apex Audiotron tubes are guaranteed, and Dealers, as well as the manufacturers, will make replacement on all tubes that prove unsatisfactory in any way. The only requirement is that the tube must not have been burned out.

Order All Tubes by Type Number

Type 201A—5 volts, .25 amperes . . **$4.00**
Amplifier and Detector

Type 199—3-4 volts, .06 amperes . . . **$4.00**
Amplifier and Detector

Type 12—1½ volts, .25 amperes . . . **$4.00**
Platinum Filament—Amplifier and Detector

Type 200—5 volts, 1 ampere **$4.00**
Detector Tube

Type 199A—3-4 volts, .06 amperes . **$4.00**
Amplifier and Detector—Standard Base

Type 202—5 watt oscillator **$5.00**

CAN BE PURCHASED FROM EVERY DEPENDABLE DEALER.

RADIO TUBE CORPORATION

671 BROAD ST., NEWARK, N. J.

What good is a good battery—neglected?

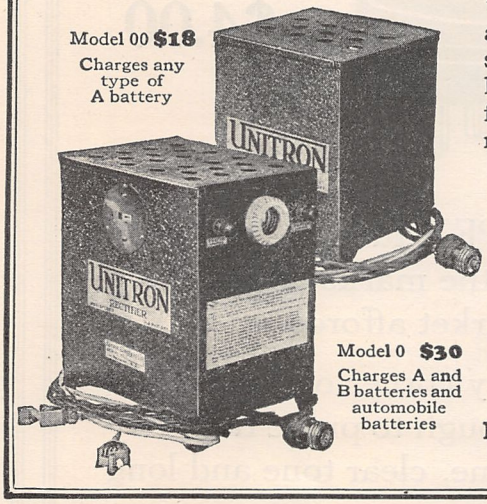
TODAY you might buy the best battery in the world. And yet within a week or two would come the chance to neglect it.

Harm follows when batteries need recharging — and don't *get* it. When you have to send your battery away for recharging, the temptation is to drain it for every bit of juice it contains. This ruins batteries. It costs you clearness, volume and distance. It spoils many pleasant evenings by the battery quitting suddenly through your trying to get just one more night on the air.

The Unitron Battery Charger makes this all unnecessary. The cost of charging is only about a cent an hour. Attached to your battery over night once a week, it keeps your set performing perfectly all the time.

It is quiet. You can't hear it three feet away. It requires no adjustment of any kind and it is simpler to operate than the simplest radio set. The Unitron is fully guaranteed, and mail orders receive specially careful attention.

Model 00 **$18**
Charges any type of A battery



Model 0 **$30**
Charges A and B batteries and automobile batteries

Send for the Story:
"More Stations on the Speaker"

FOREST ELECTRIC COMPANY
Pioneer Manufacturers of Industrial Current Rectifiers
New and Wilsey Sts., Newark, N. J.

Adv. by PICARD-SOHN, INC. N.Y.

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THE FASTEST SELLING
LINES OF HIGHEST-GRADE RADIO

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The BEST and BEST-SELLING RADIO

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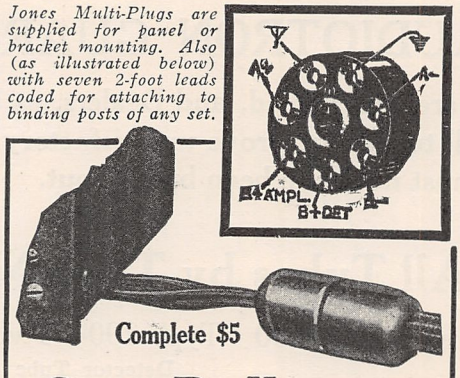
WE HELP YOU SELL RADIO

Our catalog has features that help you sell and contains the fastest selling lines of radio. Send us your name for our catalog—the Radio Red Book—and Trade Discount List.

WILLIAMS HARDWARE COMPANY
RADIO DIVISION
Distributors
110-120 Vermillion St., STREATOR, ILL.

Jones Multi-Plugs are supplied for panel or bracket mounting. Also (as illustrated below) with seven 2-foot leads coded for attaching to binding posts of any set.



Complete $5

One Pull

on the Jones MULTI-PLUG instantly disconnects antenna, ground, A and B batteries from your set! One push reconnects! Long cable permits placing batteries out of way—in basement, closet or elsewhere. All leads coded.

Jones MULTI-PLUG

Can't be plugged in wrong. Prevents burning out tubes or shorting batteries. 100 percent foolproof. Enables anyone to connect your set with safety. Standard on Zenith, WorkRite and many other leading sets. Jones Multi-Plugs, complete for panel mounting, $4; for bracket mounting, $4.50. Binding Post type, $5.00. Carried by all jobbers. If your dealer isn't supplied, state his name when ordering. Folder free.

Pat. Applied For
HOWARD B. JONES
616 S. Canal St. Chicago

Loop Antenna Transmission

(*Continued from page* 681)

in mind, design the loop for a fundamental not above one-fourth or one-half the wavelength of the signal to be received.

Assuming that wave-lengths of 200 meters and below are to be received, the loop should have a large area and not over three or four turns of wire, preferably No. 18 D.C.C. wire or better some copper ribbon or stranded cable. This will give it a low resistance and distributed capacitance. Also, the directional characteristics will be much sharper than if the loop is made smaller with a greater number of turns.

If these points are kept in mind, no trouble should be encountered in constructing an efficient loop for receiving. Should the reader deem further details necessary, he is advised to consult the article written by R. H. Langley in the July issue of RADIO NEWS.

The advantages of loop antennae employed for transmission are their sharp directional characteristics, their small linear dimensions, and their efficiency when operating on low wave-lengths. These are all factors in which the amateur is much interested at the present time. Why, then, does he not make and encourage experiments along these lines with the loop antenna as a radiator?

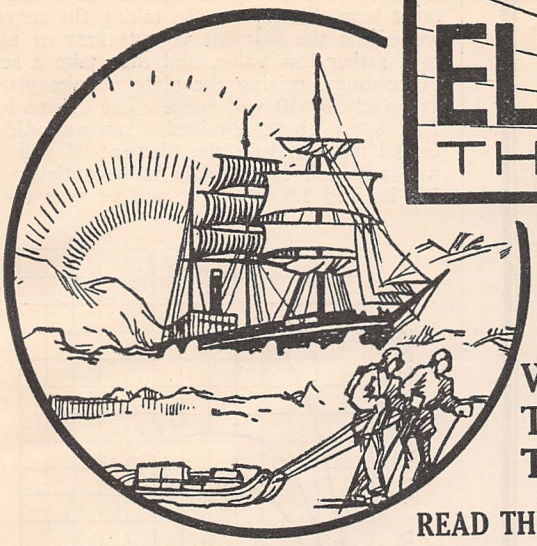
What Vacuum Tube Curves Mean

(*Continued from page* 699)

beautiful sweep of enormous size. If the grid current is one microampere at zero volts the grid curve would cross the center line .432 in. or rather less than ½ in. from its base. The backlash kink would be represented by a curve coming .0432 in. below the line, or about half the thickness of the standard spacing washer used in variable condensers! If we wish to carry the experiment rather further by drawing on the same scale a current-consumption curve for the filament of the tube we shall have to make our center line 12,000 yards or nearly seven miles in length.

THE EMISSION CURVE

The last curve of importance is the emission curve, which helps us to determine the correct filament potential at the normal plate voltage of the tube. To take this curve we proceed as shown in Fig. 7, connecting the grid and plate together, and placing a milliammeter in the "B" battery circuit. The arrangement shown, of course, produces a condition such as will never occur when the tube is used on the receiving set, for it is unlikely that the grid will, at any time, be more than two or three volts positive at the outside. Our object is, however, to collect and pass through the milliammeter the largest possible proportion of the whole number of electrons emitted by the filament. It is usual to work to an entirely arbitrary figure of five milliamperes, taking this as the desirable emission under these conditions. When we have found a filament potential which gives a total emission of five milliamperes for a receiving tube at a reasonable plate voltage, we may take it that this is the correct filament reading for the tube, and that it will function well on the receiving set with the rheostat



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IDEAL FOR LOOP AERIAL.
No further Insulation necessary

Extract from the "Wireless Weekly," June 25th, 1924.

THE ALGARSON ARCTIC EXPOSITION.
ELECTRON WIRE IN THE ARCTIC

A good deal of public interest has been aroused by the Algarson Expedition from the Thames for the Arctic Circle. After the work is finished in the Arctic, **THE VESSEL WILL RETURN DIRECT ACROSS THE ATLANTIC TO NEW YORK IN NOVEMBER.**

Their destination is a point some 200 miles from the Pole. She is a small vessel of 23 tons, and there was some difficulty in erecting the aerial. She possesses two masts between which it was quite impossible to string the aerial in the usual position, because her sails would have fouled it. A downlead between the two mast heads was entirely ruled out by the arrangement of the rigging. The only possible position for the span of the aerial was between the masthead and a point in the bow, the aerial being of the twin type with 6 foot spreaders. The only possible point from which the downlead could be taken proved to be the upper end of the aerial, and a most difficult problem arose as to how this was to be brought down to the level of the deck. It could not be brought in the obvious manner straight down the mast, because it would have interfered with certain of the running rigging, and the only possible route for it proved to be down the steel ratlines, no doubt a very undesirable method, but the only possible compromise in the circumstances. Even after the arrival upon deck, the lead had to follow a somewhat devious route for some distance along under the bulwarks, and then across the deck, and through a skylight. Since a great part of the route of the downlead was liable to be wetted by spray at any time, and also to be submerged at intervals by seas breaking inboard, the question of the type of wire to use for this and for the aerial itself, whose lower extremity was liable to similar treatment, was naturally a serious problem. Remembering the corrosive action of sea water, it was obvious that an extremely durable form of insulated wire was necessary, led to the choice of ELECTRON, the Cable now being sold by The New London Electron Works, Ltd. ELECTRON wire has great mechanical strength and resistance to corrosive influences, **AND USED FOR THE WHOLE OF THE AERIAL AND THE DOWNLEAD.**—Extract from the "Wireless Weekly," June 25th, 1924.

THE SECRET OF "ELECTRON" WIRE

Wireless experts agree that the ether waves flow only on the surface or skin of the conductor which carry them. Therefor, aerials which consist of several small wires stranded together are more efficient than a single wire of thicker gauge.

It is also an established fact that SILVER is the finest conductor, closely followed by TIN. Silver is not only too expensive to use generally as an aerial, but for many technical reasons it is impracticable. On the other hand, Tin, an expensive conductor, four times the value of copper, lends itself admirably, because it can so easily be coated on other wires of the necessary strength and durability, and therefore fulfils the purpose of a perfect conducting "Skin." The secret of Electron Wire is that each separate strand of wire is scientifically coated with a skin of pure tin. Enthusiasts who are using "Electron" Wire in all parts of England and America report wonderfully clear results with either crystal or tube sets. The ether waves penetrate the protected coverings, all incoming signals being held. Suspend "Electron" Wire where you will, lead direct to the set (no separate lead-in required), use "Electron" Wire for earth, and a greatly improved reception will be the result.

EXTEND YOUR 'PHONES or loud-speaker to any part of the house or garden with "Electron" Wire, which being insulated with vulcanized rubber, no further insulation is necessary. You may allow it to touch anything anywhere, indoors or out-of-doors, in perfect confidence. "Electron" Wire has no equal at ten times the price.

"Electron" Wire is ideal for all kinds of Indoor Aerials, Loop Aerials, etc. There is plenty of scope for experimenting. Try every possible way of erecting, and quite likely some new arrangement will be found which will be of great help to others. The set should be as near as possible to the aerial. Lead in at right angles in one continuous length.

The CHEAPEST AERIAL and the Best in the World.

100 ft. $1.50

If you cannot get Electron Wire from your local dealer, send us his name and address and $2.50 direct to us and we will send 200 ft., sufficient for a complete aerial, lead-in and ground with copper terminals fixed ready for immediate erection.

Expressage or postage paid

Prices for larger quantities & on original drums upon application

INDOOR AERIALS.—"Electron" Wire has been used with great success; Round the Picture Rail; Round the Cupboard Door; Parallel across the Room; Along the Corridor; Round a Fire Screen, and almost everywhere.

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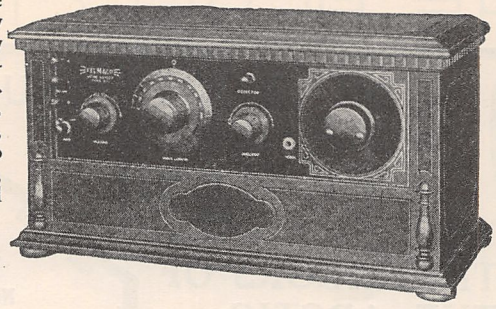
The Ideal Receiver for all Seasons

The Telmaco Acme Receiver is truly portable. Entirely contained in beautiful traveling case. Tubes, batteries, loop, loud speaker, everything built into set. No outside loop, no aerial, no ground required.

Size of Case 8" x 10" x 18". Weighs only 27 pounds complete. *Easily Carried.*



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securing selectivity, distance and volume with minimum battery consumption.

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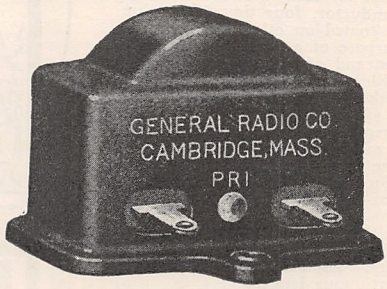
The Ideal 30 K-C Transformer



Type 271
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The Type 271 transformer was designed *specifically* for *amplification* of *medium frequencies*, and is not merely an adaptation of a radio or audio frequency transformer.

In superheterodyne sets four of these instruments give excellent results without a tuned input or output transformer.

Price $5.00

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GENERAL RADIO Co — Cambridge, Mass. U.S.A.

so adjusted that the voltage across its filament is at this figure. In taking the curve we adjust the filament voltage first of all to a rather low value, and then take a set of readings, raising the plate voltage progressively by 10 volt steps. The curves in Fig. 8 are those obtained from an oxide coated filament tube the filament of which was adjusted successively to potentials of 1.5, 1.6 and 1.8 volts. It will be seen that

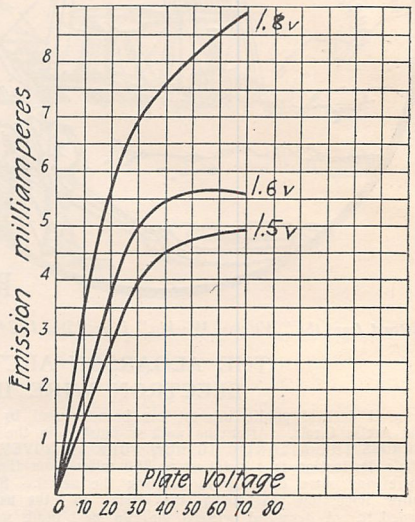

Fig 8. Emission curves of a tube obtained with different filament voltages.

at 1.5 volts the desired figure of 5 milliamperes is not reached at all. The raising of the plate voltage from 40 to 70 volts produces only a slight rise in the emission; in fact, with 30 volts on the plate the curve begins to bend round showing that we are approaching the maximum point. With 1.6 volts on the filament things are better. We do reach 5 milliamperes, but the curve begins to bend rather sharply with the plate about 25 volts positive. By raising the filament potential to 1.8 volts we obtain a very much better curve which shows

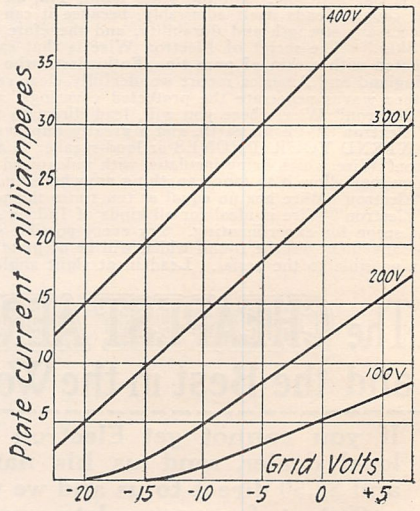

Fig. 9. The grid volts divisions are the same size as the milliampere divisions, giving the impression of a flat curve.

us that we can obtain a steadily increasing emission as the plate voltage is raised to 70. 1.8 volts may, therefore, be taken as the correct filament voltage for the tube under test.

SOME PITFALLS

We have rightly had drummed into our heads both in radio books and in articles on tubes that a straight "steep" grid volts-

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At the Atlas Radio Stores you get genuine parts, of the finest quality—bought direct from the makers at the lowest possible prices. The great buying power of our six big retail stores and wholesale and mail order departments guarantees the lowest prices. And we share this saving with our customers. Send for our big complete catalog. The items listed here are only a few of our bargains:

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1 Tube Ultra Audion

This 1000 mile range set is very popular with beginners. Set is complete, including cabinet; without tube, batteries or aerial; full blueprint instructions—very simple.
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These kits are made up of material produced by the makers of the Erla Reflex Sets, the Electrical Research Laboratories. They are absolutely complete in every detail, even including drilled panel. All screws, connectors and binding posts are in these kits. The only tools necessary to produce a perfect operating set, so far as the quality of the parts have to do with it, are screwdriver and pliers. No soldering necessary.
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Bremer-Tully Condenser

C11	11 plate .00025 mfd.	$2.25
C23	23 plate .0005 mfd.	2.45
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5 Tube Bremer-Tully Nameless Circuit

This is the new circuit that is proving so marvelously popular because of its power, range and clearness. Our kit of this receiver is absolutely complete in every detail with the new style B. T. transformer. If you want a powerful, yet simple receiver, you should build this one.
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6x10½"	5½"	10"	7"	2.40
7x10"	6½"	9½"	7"	2.55
7x12"	6½"	11½"	7"	3.00
7x14"	6½"	13½"	7"	3.15
7x18"	6½"	17½"	7"	3.40
7x21"	6½"	20½"	7"	3.80
7x24"	6½"	23½"	7"	4.30
7x26"	6½"	25½"	7"	5.45
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Look at our very low prices on this fine quality material. Cheaper than hard rubber panels which are worth much less. We supply genuine Bakelite. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Polished black finish, can be sanded in oil. All prices prepaid.

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7x18	1.73	2.22	3.45
7x21	2.00	2.60	5.05
7x24	2.37	2.92	....
7x26	....	3.20	....
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A special compound having a rubber base. Smooth, finely polished finish. Easily drilled or cut without chipping. Does not warp. Perfect insulator for radio use. Smooth, clean edges.
Thickness 3/16". Size given is in inches.

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The ones found most popular.

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Guaranteed 24 Months

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The combined weight of the complete set less than 6 ounces.

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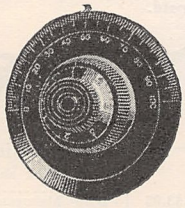
Radio Dials



Smooth easy movement, no back lash, no cogs or gears. Simple to put on. Take off your old dial, slip on an E-Z-Toon and tighten the set screw. A dial ratio of 50 to 1 gives you vernier adjustment never obtainable before. Ask your dealer. If he can't supply, write us.

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You can save $55.50 on a Model No. 8 L. C. SMITH—the genuine "Silent Smith"; or you can save $66.00 on a Model No. 5!

Like New in Looks and Service

Both are literally like new! Guaranteed for 5 years. Each has all latest improvements. Standard keyboard; 84 characters. Ball bearing shift, carriage and keys; two-color ribbon, etc. No. 8 "Silent Smith," in addition, is SILENT. It has the newest decimal tabulator.

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plate current curve is one of the things that we must look for in a tube. Those who examine curves are, therefore, apt to be led astray by their shape, not always realizing that you can make any curve into a steep one by decreasing the size of your grid volts division and increasing the size of those representing milliamperes. Makers naturally wish to do the best for their own products, and for this reason you will generally find that the curves which they give do not err in the direction of gentleness in their slopes. A cursory examination of the two sets of power tube curves given in Figs. 9 and 10 will probably give the impression that the latter are by far the steeper. But if the two are looked at with

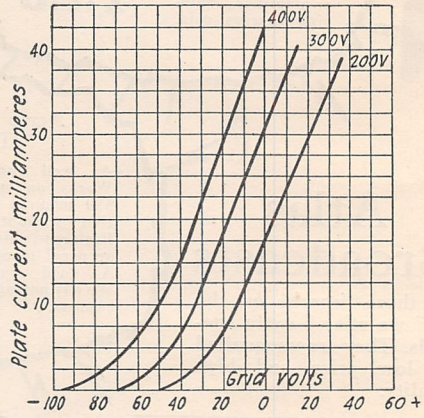

Fig. 10. Here the milliampere divisions are four times the grid volts divisions which gives the appearance of steep curves.

care it will be seen that the grid volts divisions of the former are the same size as the milliampere division, while the milliampere divisions in Fig. 10 are four times the size of the grid volts. For this reason the curves in Fig. 9 appear to be much flatter than those in Fig. 10. If, however, the two are drawn out to the same scale, it will be found that the truth is precisely the reverse of this. Both are curves of power amplifiers of great efficiency. It will be seen that good audio frequency amplification may be expected even with 100 volts upon the plate with the tube the curve of which is shown in Fig. 9. The grid bias required in this case will be five volts negative, and there will be no distortion since the curve is quite straight between zero and -10 volts. We shall do better still with 300 or 400 volts upon the plate, for here we have absolutely straight lines and we can apply a grid biasing potential of 15 volts or more which will entirely eliminate the flow of grid current even if the tops and bottoms of the waves to be dealt with represent a rise and fall of eight volts above or below zero. The second tube, the curves of which are shown in Fig. 10, will function well with 200 volts on the plate and a negative grid bias of 10 volts. With a plate voltage of 400 we can apply 30 volts negative bias to the grid, thus cutting down grid current and effecting great economy in the "B" battery current without undue loss of signal strength.

Though it is impossible in one short article to go fully into the question of tube curves, it is hoped that enough has been said to give readers a good indication of the information about any tubes which they can obtain from a careful inspection of their various curves. The curves usually published by makers are those showing the effects upon plate current of varying grid potentials at different plate voltages. Most manufacturers, however, will supply other curves if asked to do so. In conclusion, every user of tubes should make himself

for scientific tube tuning

With the new and improved FIL-KO-STAT you get a battery switch that fits the FIL-KO-STAT mounting screws. This switch—"at your finger tips"—enables you to turn the current "on" or "off" without disturbing the FIL-KO-STAT'S adjustment *and it distinctly signals "on" or "off".* FIL-KO-STAT is the only radio rheostat enabling you to get maximum reception, bringing in stations you never heard before and cutting out tube noises. It lengthens tube and battery life and permits infinite adjustment of any type tube in any hook-up. It's unconditionally guaranteed.

FIL-KO-STAT

SCIENTIFICALLY CORRECT RADIO RHEOSTAT

with Battery Switch

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In Canada $2.75

The Use of FIL-KO-PARTS for Radio Guarantees Satisfaction. The Reputation of the Makers stands back of the Guarantee!

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You lose many DX stations through leakage in the antenna circuit. Make sure all radio impulses reaching the antenna reach your radio set. The FIL-KO Lightning Arrester will help you, because it's "Umbrella" shield keeps dust, rain, etc., from the moisture-proof, hermetically sealed Bakelite insulation and prevents partial grounding of the antenna. And what's more the FIL-KO-ARRESTER carries a guarantee that's virtually an added insurance policy. You get positive protection for $1.50

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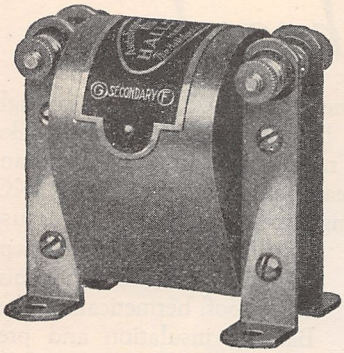
with clear tone, undistorted reception, wide range and large volume



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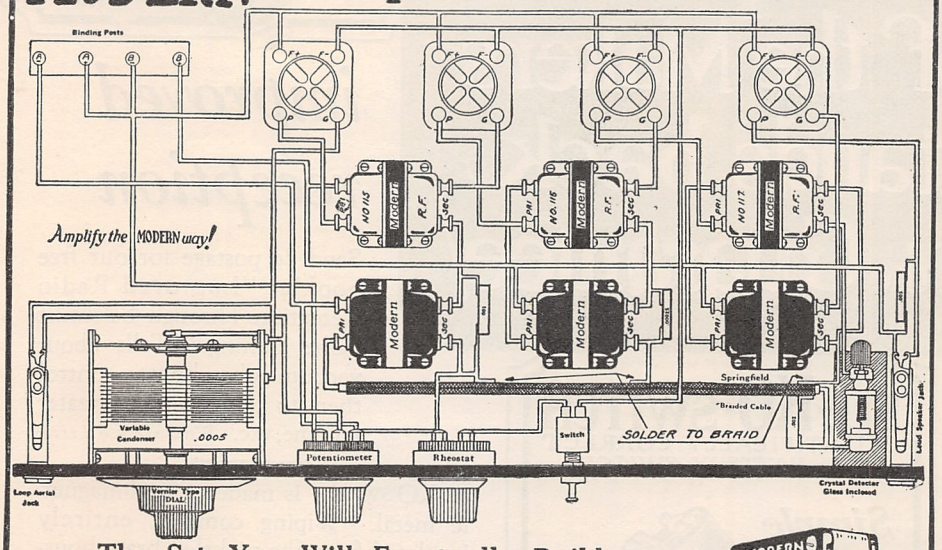

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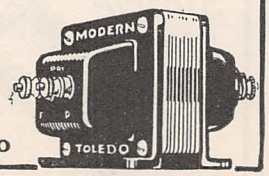

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familiar with curves, for he then knows exactly what he is doing when he varies grid or plate potentials, moves the slider of the potentiometer, or adjusts his grid biasing battery. There is a great deal more pleasure in working systematically than can be found in any sort of hit or miss methods.

Multi-stage Radio Frequency Amplification

(*Continued from page 690*)

cuits. In the latter case, of course, if we increase the wave-length of the tuned plate circuit above that of the grid circuit to any appreciable extent, the tube will cease to function as a radio frequency amplifier, whereas in the case of the Fig. 8 or Fig. 9 circuits, large increases in the plate inductance do not prevent the tube acting as a radio frequency amplifier, and the so-called aperiodic inductance may be used to couple two tubes together, although it is true the degree of amplification is not large.

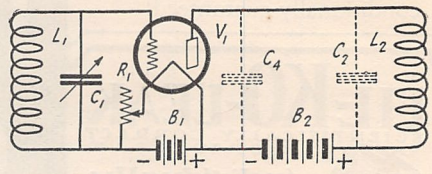

Fig. 9. The plate-filament capacity of the vacuum tube is represented by C4 and the distributed capacity of the plate coil L2 by C2.

The main point I desire to bring out here is that the fact that there is no variable condenser in the plate circuit of the tube does not mean that there is no tendency for the tube to oscillate—a very commonly experienced phenomenon in connection with the ordinary regenerative circuit where an aperiodic tickler coil is coupled to a tuned grid circuit for increasing signal strength. If a certain size of tickler coil is used, the coil and the capacities mentioned form an oscillatory circuit which may be tuned to the same wave-length as the grid circuit. Under these conditions the receiver will be difficult to operate and may oscillate without there being any direct magnetic coupling between the tickler coil and the grid coil.

In the case of the radio frequency amplifier where there is a tendency to self-oscillation, it is equally important to avoid self-oscillation due to a so-called aperiodic coil in the plate circuit being actually tuned to the same wave-length as the grid circuit.

When using the Fig. 9 type of circuit and using the inductance L_2 as a means of coupling the tube V to a succeeding tube, it is undesirable to have the coil L_2 smaller than the coil necessary to produce a natural wave-length in the plate circuit equal to the wave-length, to which the grid circuit is tuned. It is better to have the coil larger so that the natural wave-length of the plate circuit is greater than the wave-length of the grid circuit. These considerations, however, do not apply in the case where a radio frequency transformer is used to couple one tube to the next.

THE CASE OF RADIO FREQUENCY TRANSFORMERS

Radio frequency transformers generally have either the primary or secondary windings tuned, and sometimes both.

If the primary winding, *i.e.*, the one in the plate circuit, is tuned, the tube will have

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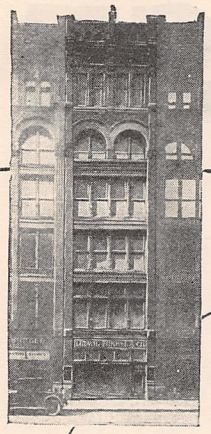

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all the same tendencies towards self-oscillation as the fundamental tuned plate circuit illustrated in Fig. 1. The same applies in the case where both the primary and secondary windings of the radio frequency transformer are tuned.

While, however, the primary winding is untuned and the secondary is tuned, quite a different state of affairs exists, and this method of coupling is one which can be consequently recommended.

A typical amplifying circuit in which these conditions obtain is illustrated in Fig. 10. We here have in the plate circuit of the tube the primary L_2 of the radio frequency transformer L_2, L_3. In this circuit the coupling between L_2 and L_3 is variable, and a variable condenser C_2 is connected across the secondary L_2 for the purpose of tuning.

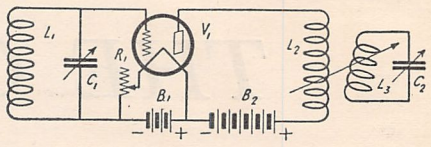

Fig. 10. The variable values L3-C2 compose a tuned oscillatory circuit; this figures in the control of the value of the plate coil L2.

Let us first consider the state of affairs when L_3 is at right angles to L_2 and there is no effective coupling between the plate circuit of the tube and the tuned circuit L_3, C_2. The circuit, which now ignores L_3, C_2, resolves itself into the arrangement of Fig. 9, and the same conditions apply. If the coil L_2 is small there will be no tendency whatever for the tube to oscillate; if, however, the coil L_2 is of such particular size that when its own self-capacity and the self-capacity of the tube are acting across it, the wave-length to which it is tuned is equal to the wave-length to which the grid circuit is tuned, then the tube will probably oscillate. If, however, the coil L_2 is made larger than this critical value of inductance, then once again there will be no trouble from self-oscillation of the tube. This point has to be noted in the design of suitable radio frequency transformers.

These transformers may either consist of, say, two honeycomb coils variably coupled, or the commercial article in which the coupling between the two coils is fixed. As the design work in radio frequency transformers has already been performed, the experimenter is not likely to be concerned with the present discussion, except from the technical interest standpoint. If, however, it is proposed to use two honeycomb coils as the transformer, thes theoretical considerations have a very practical importance because, if the experimenter uses, say, a No. 100 or 150 honey-comb coil as the primary of his radio frequency transformer when receiving stations on the 300 to 500 meter waveband, he may wonder why it is that the tube is so unstable; he will probably find that by using a No. 75 honey-comb coil as the primary, his troubles will disappear and the reasons are those here stated.

Assuming, then, that the coil L_2 is not of the critical size, we will proceed to the consideration of what happens when L_3 is brought up close to L_2. No matter how close the coupling between L_3 and L_2, provided the circuit L_3 C_2 is not tuned to the same wave-length as the grid circuit, the tube will not oscillate.

If, however, the circuit L_3 C_2 is kept tuned to the same wave-length as the grid circuit, then, as L_3 is brought closer to L_2 the tendency to oscillate will increase with the tightness of the coupling. Here again is an effect which many experimenters do not fully appreciate. It is not possible to regard the two windings L_2 and L_3 as entirely separate; it is not possible to say

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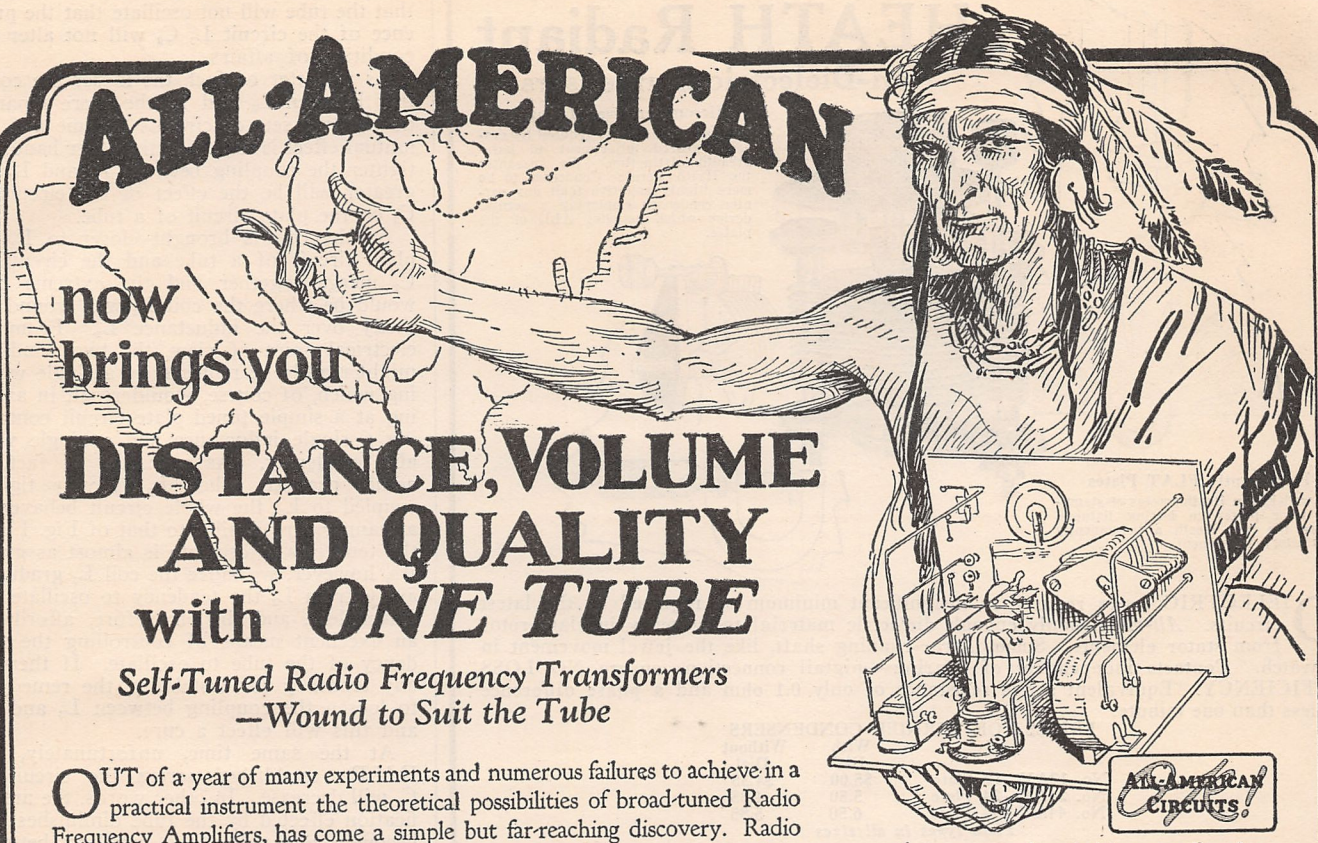

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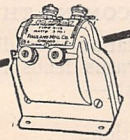

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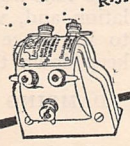

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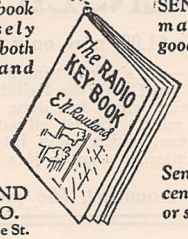

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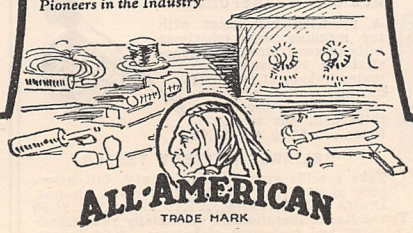

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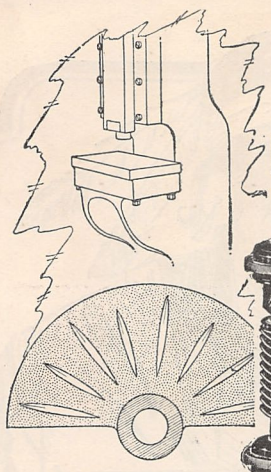

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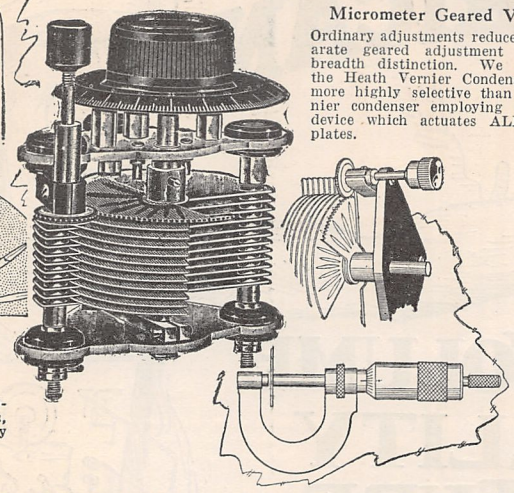

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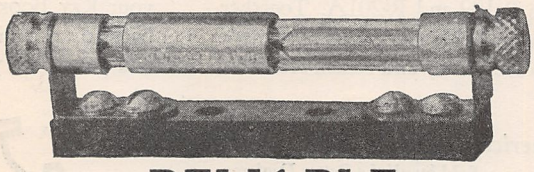

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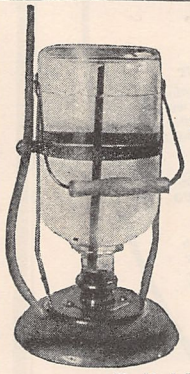

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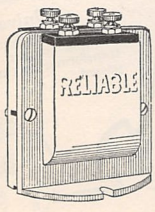

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that because the coil L_2 has been so chosen that the tube will not oscillate that the presence of the circuit L_3 C_2 will not alter the condition of affairs.

As a matter of fact, the looser the coupling between L_2 and L_3 the more separate do the two sets of circuits become and the mutual effect is less. On the other hand, the tighter the coupling between L_2 and L_3 the greater will be the effect of the circuit L_3 C_2 on the plate circuit of a tube.

As the coil is brought closer to L_2 the plate circuit of a tube and the circuit L_3 C_2 merge together and the extreme case would be where the coil L_3 was wound directly over the inductance L_2. From an electrical point of view, the two windings might readily be replaced by a single winding which, of course, would result in arriving at a simple tuned plate circuit containing a single inductance and a single variable condenser. As a matter of fact, in actual practice, when L_3 is very tightly coupled to L_2, the whole circuit behaves in a manner very similar to that of Fig. 1, and the tendency to oscillate is almost as great. As, however, we move the coil L_3 gradually away from L_2 the tendency to oscillate becomes less, and this, therefore, affords us an excellent means of controlling the tendency of the tube to oscillate. If there is any tendency for instability, the remedy is to loosen the coupling between L_3 and L_2, and this will effect a cure.

At the same time, unfortunately, the E.M.F.s established across the circuit L_2 C_2 will decrease. In other words, the amplification effected by the tube diminishes and becomes zero when the coupling between L_2 and L_3 is zero. We are therefore faced with the alternative of a tendency to oscillate and good signal strength or greater stability and weaker signals. It is, however, to be noticed that very frequently if the coupling between L_2 and L_3 is too tight, signals are rather weaker than if the coupling between L_2 and L_3 is a little looser. It will usually be found that there is a certain coupling between L_2 and L_3 which gives the best results; loosening the coupling still further will result in still greater stability but weaker signals.

OVERCOMING THE TENDENCY

Self-oscillation in radio frequency amplifying apparatus lends itself to two forms of treatment:—

1. Cure.
2. Prevention.

It is very much easier to cure self-oscillation than to prevent it. The word "cure" in this sense is meant to indicate that self-oscillation troubles are in existence when the circuit is designed, and that some kind of a brake must be put on the circuit to prevent it. By "prevention" I mean the designing of a circuit so that no self-oscillation tendency will arise.

Cure implies that the circuit has to be "tied down" by various expedients, all of which involve energy loss and consequent loss of amplification. Prevention, on the other hand, implies no energy loss but a full development of amplification.

The easiest and most undesirable method of obtaining radio frequency amplification is to take no precautions to avoid self-oscillation and, when the effect is experienced, to introduce energy consuming devices to keep down the oscillations.

DAMPING METHODS AND A COMMON FALLACY

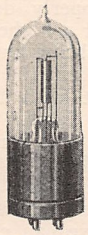
The earliest, and even at the present day, the most popular method of reducing the tendency of a tube amplifier to oscillate, involves the introduction of damping into one or more of the oscillatory circuits.

This, however, is merely a palliative for the trouble, and there is a common fallacy

TYPE 199

3-4 volts .06 amp. Amplifier and Detector with Standard Base Type 199A.

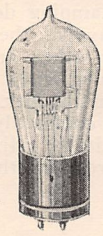
PRICE $4.00



TYPE 12

1½ volts .25 amp. Platinum Filament Amplifier and Detector

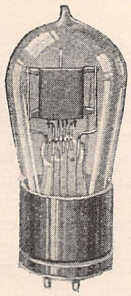
PRICE $4.00



TYPE 200

5 volts 1 ampere Detector Tubes

PRICE $4.00



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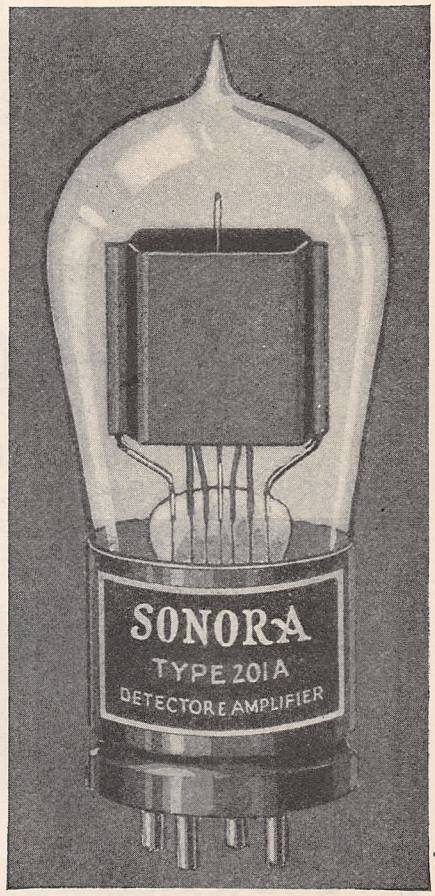

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(5 Volts—¼ Ampere)
Detector-Amplifier

PRICE $4.00

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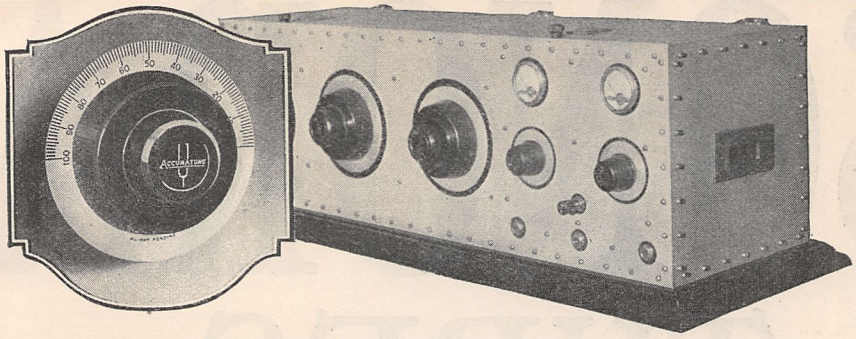

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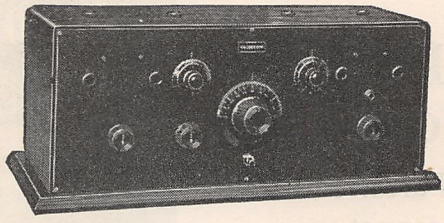

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THE Halldorson 4-tube set for $75.00 is one of the greatest values ever offered in radio receivers. Everything formerly found only in high-priced sets you'll now find here.

The set is tuned radio-frequency, easy to tune and operate. Coast-to-coast range. Highly selective-large volume, with a clear mellow tone. Operates from either dry cells or storage batteries. The workmanship and material are of the best—standard parts throughout—highly polished mahogany case. The panel is of insulated steel, in a beautiful stucco-ripple finish, with large handsome dials.

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Also the Halldorson 5-tube Radio Frequency Receiver. A superior set, unequalled for all-around performance. A wonderful value at $115.00.

Halldorson
Radio Frequency Receiver

THE HALLDORSON COMPANY, 1772 WILSON AVENUE, CHICAGO

which many believe in connection with this method of obtaining stability. It must first be understood that a tube will oscillate even though the degree of amplification is small, and that, however inefficient the amplification may be, it is nearly always possible, by having suitable coupling between the plate and grid circuits of the tube to obtain self-oscillation. It is possible, for example, to get self-oscillation when the tube is only giving a double amplification, whereas for proper amplification the multiplication should be of from four to seven times, although this is rarely achieved. If, however, the circuits are designed without any regard to the prevention of self-oscillation, the tube will readily oscillate, even though the amplification may be very low. If, now, we introduce damping devices and energy consumers, the degree of amplification will be still lower.

The fallacy is to imagine that because the tube is adjusted to the pre-oscillation point, a very high degree of amplification is being obtained. Nothing is further from the truth, and with a properly designed circuit it is possible to get a higher amplification without the circuit being anywhere near oscillation point than in the case of a poorly designed circuit with the reaction adjusted to the critical value.

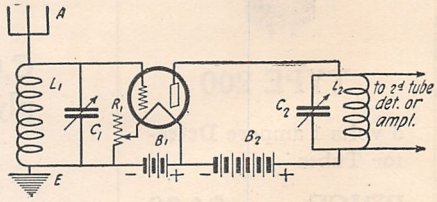
Energy consumers in tube amplifying circuits may be compared to the effect of a brake on a high speed motor car. If we desire to obtain a speed of, say, 30 miles per hour with a car, we can either adjust the engine controls, etc., so that normally a speed of 60 miles per hour would be obtained, and then apply brakes to ensure that the speed does not exceed 30 miles per hour, or we can use a lower-powered car without attempting to apply brakes.

An examination of the kind of brakes applied to tube amplifiers will now be made.

ADDING DAMPING TO A RADIO FREQUENCY AMPLIFIER

The application of damping devices to a tube amplifier may involve the introduction of resistances or other energy consumers, or the damping may be introduced in a very natural manner.

This latter method is commonly employed and may consist in suitably adjusting and arranging the aerial circuit of the receiver.

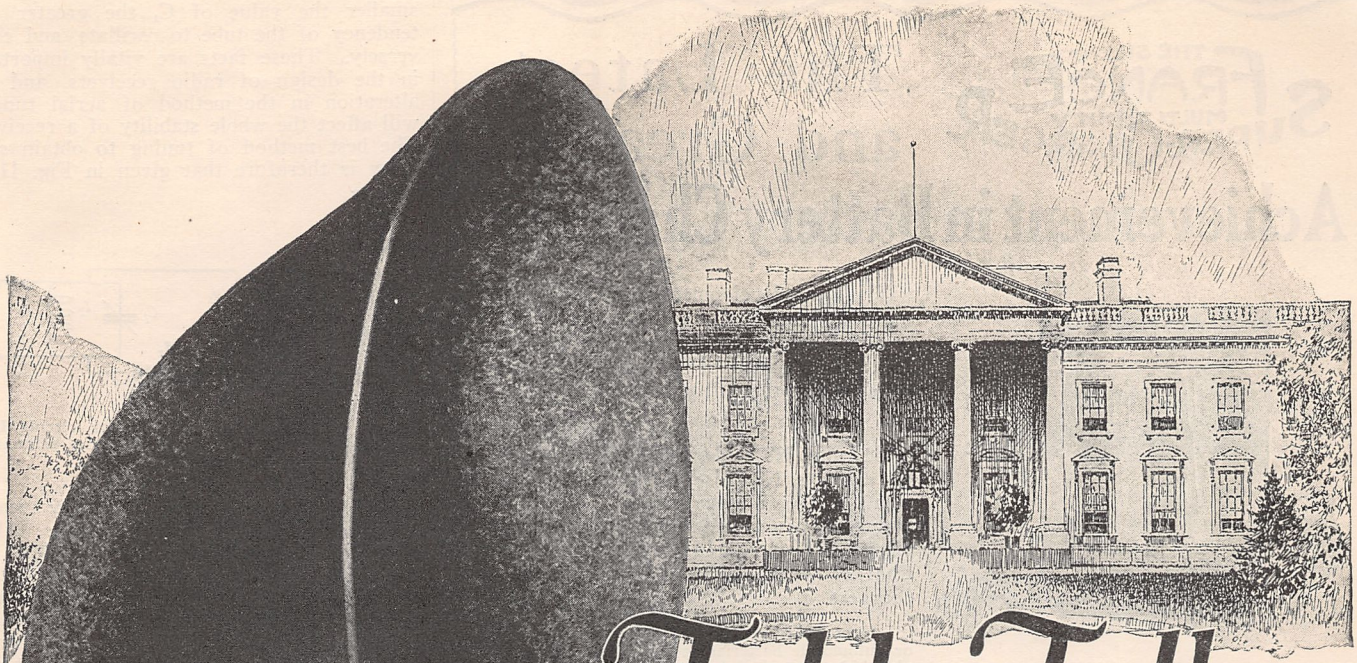


Since the grid circuit of this tube is connected directly to the antenna system, it is loaded and in consequence the tube finds greater difficulty in oscillating.

Fig. 11 shows a radio frequency amplifying tube with its grid circuit included in the aerial circuit. This is commonly known as direct coupling, and by this means the heaviest load is placed on the grid circuit, and if the tube wishes to oscillate, it will not only have to oscillate the grid circuit, but also the whole of the aerial circuit. The tube would find it much harder work to oscillate the whole of the aerial circuit than merely a loose and free tuned grid circuit. A motor-generator will tend to run at a much higher speed when there is no load than when a heavy current is being drawn from it. Likewise a tube will tend to oscillate much more readily when there is a minimum of load on the grid and plate circuits.

In Fig. 11 the aerial is tightly coupled to the grid circuit, and therefore the damping of this circuit is greatest.

The tendency to oscillate will be greater



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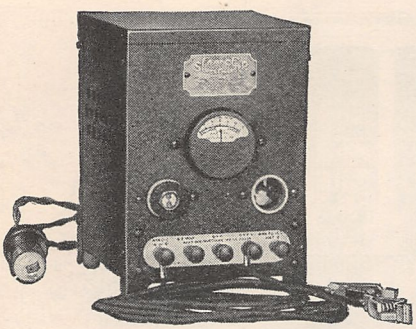

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It economically charges 2, 4, or 6 volt radio or automobile batteries at 5 or 7 ampere rate, also 120 volts of B battery IN SERIES at a desired varying rate—an exclusive feature. No wires to change before charging. Simple. Quick. Convenient.

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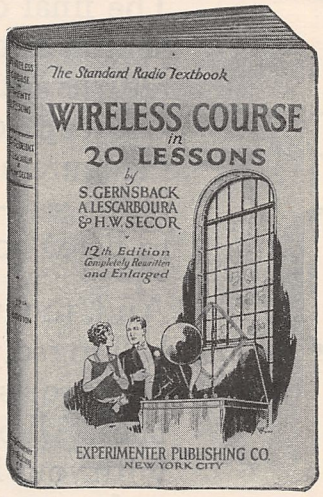

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the smaller the aerial. Moreover, the smaller the value of C_1 the greater the tendency of the tube to oscillate, and conversely. These facts are vitally important in the design of radio receivers, and an alteration in the method of aerial tuning will affect the whole stability of a receiver. The best method of tuning to obtain stability is therefore that given in Fig. 11.

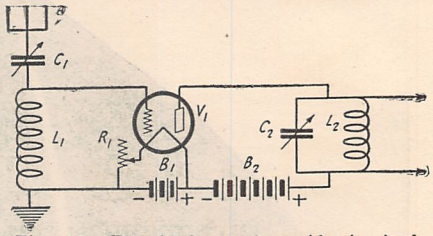

Fig. 12. The load on the grid circuit is greatly reduced by the use of a series antenna condenser.

Fig. 12 shows the aerial tuned by means of a series variable condenser C_1. This method of tuning involves a smaller load on the grid circuit, which circuit, however, now includes the aerial as an essential part. This circuit will tend to oscillate more readily than that of Fig. 11, and in circuits where it is difficult to obtain sufficient regeneration, series tuning will be found beneficial.

Fig. 13 shows my constant aerial tuning method, which consists in connection a .0001 mfd. fixed condenser in the aerial lead for the purpose of making the receiver substantial independent of the aerial constant. This constant aerial tuning method makes

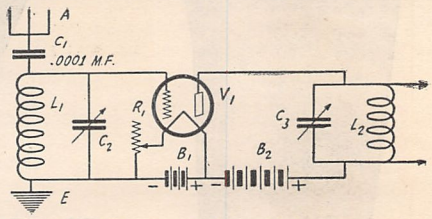

Fig. 13. The constant aerial tuning method employed by the author.

it possible to specify what coil to use to cover a given wave-length range on any aerial, it improves selectivity and makes it easier to obtain regeneration.

This last quality is, in the case of a multi-stage radio frequency amplifying system, rather a disadvantage, because it tends to make the first tube unstable. The load on the grid circuit in Fig. 13 is now less than in either Fig. 11 or Fig. 12, and consequently amplification works where there are two or more stages (unless, of course, the circuital arrangements employed are in themselves sufficient to prevent a tendency to self-oscillation).

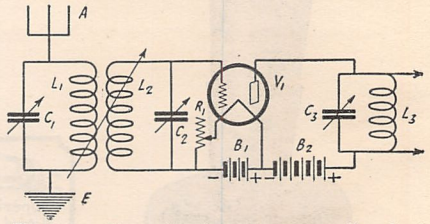

Fig. 14. The grid circuit here is relieved of the load of the antenna system by employing indirect coupling.

Fig. 14 shows a loose-coupled arrangement in which the aerial circuit is loosely coupled to a tuned grid circuit. In this circuit the damping of the grid circuit, and therefore the tendency of the tube to oscillate, depends essentially upon the coupling between L_1 and L_2, and the tuning of the aerial and grid circuits. If the coupling between L_1 and L_2 is tight, the load on the

THE NEW MODEL C-7 SUPER-HETERODYNE

Important Today

THE EXPERIMENTERS INFORMATION SERVICE, Inc., has been recommending the Super-Heterodyne method of reception since the early part of 1922. In February, 1923, a Super-Heterodyne of our design was installed on the *S.S. Western World,* pier 1, Hoboken, N. J., in the cabin of Dr. Horatio Belt. On the voyage to Rio de Janeiro, Brazil, at a distance of 3,000 miles, southeast of New York, the entire Greb-Gardner fight was received from WJZ, with sufficient audibility for the entire cabin full of passengers to hear the bout, blow by blow, plainly. At 3,300 miles southeast of New York, an entire evening church service was received from Pittsburgh. At that time there was not another single firm advertising or advocating the Super-Heterodyne. Since then Mr. A. Ancieux, Engineer, Trarivia Elec de Arequipa, Arequipa, Peru, has reported consistent reception from KDKA, WDAP, WEAF, WGY and others, a distance of over 5,000 miles, using a Model "C" Super-Heterodyne. The Pratt & Brake Corp., of New York City, sent a Model C to Rio de Janeiro which received American broadcast station at a distance of over 7,000 miles.

Practically all concerns now featuring Super-Heterodyne have copied our original Model C design, and to prove again that we are far in advance of competition, we present this Improved Model C-7 Super-Heterodyne as the *Most Sensitive, Most Selective,* and finest reproducing Broadcast Receiver that can be built.

7 Tubes Give the Results of 10

The Reason:—When regeneration is added to a one tube non-regenerative receiver, the increased amplification is about equal to adding two stages of tuned radio frequency amplification. Heretofore it has been impossible to add regeneration in the 1st Detector of a Super-Heterodyne and accordingly this has been a big loss.

The new Model C-7 Super-Heterodyne has a special 1st Detector circuit with a split antenna inductance so arranged that normally the detector would oscillate continually. However, in addition, a neutralizing condenser is inserted in the circuit which gives absolute control of the oscillations to such an extent that the circuit can be adjusted to just below the oscillating point, as this adjustment gives the maximum regenerative amplification. The new circuit has a bias potential on the 1st Detector grid, in place of the usual grid leak and condenser, and this allows infinitely weak signals to be regenerated and heterodyned through the radio frequency amplifier, which an ordinary grid leak and condenser would block. On a weak signal the difference in sensitivity is very noticeable. Using a 22-foot indoor antenna in the suburbs of New York loud speaker reception has been obtained from KGO, Oakland, California. A normal range of 2000 miles is easily obtained on an average small antenna at night under average conditions.

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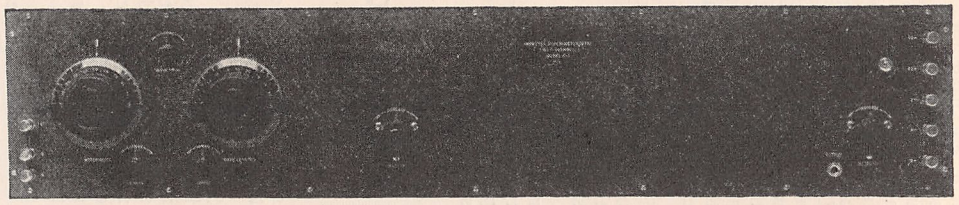

MODEL C-7 SUPER-HETERODYNE

Wave-length Range, 200 to 575 meters. Dimensions, 40 in. x 8 in. x 8 in.
Tube Arrangement: Regenerative Detector, Oscillator, 2 Stages Radio, Detector, 2 Stages Audio.

General Information

ANTENNA: Single wire, 30 to 150 feet long. Provision has been made for use of either a short or long antenna. Indoor antenna works very satisfactory.

TUBES: 7 Radiotrons UV201A or C201A, requiring one 6 volt storage battery and one 90 volt B Battery either dry or storage.

DRY CELL TUBES: Radiotrons UV199 or C199 may be used if desired, but the results obtained with dry cell tubes are not as satisfactory as with the Radiotrons UV201A or C201A.

LOOP: As a loop takes considerable space and is objectionable looking, and furthermore an inefficient collector, no provision has been made for loop reception. Local reception can be had without antenna or ground. An indoor antenna 30 to 50 feet long is suggested in place of a loop.

SELECTIVITY: The degree of selectivity is so high that distance stations can easily be tuned in through the local stations. For example, with a C-7 located five miles from WJZ operating on 455 meters, WCAE Pittsburgh on 462 meters can be tuned in without interference with WJZ.

TUNING: There are only two tuning adjustments, one for the detector circuit and one for the oscillator. Each station has a definite point on each dial and will always be found at these calibrations. Individual Verniers are provided for each dial. A third Vernier controls the volume.

CONSIDERATIONS: The Second Harmonic feature could be used with a view to eliminating another tube, but we feel that the many advantages of having a separate oscillator more than compensates for the extra tube. For a similar reason we have refrained from Reflexing the circuit to reduce the number of tubes.

STANDARDIZATION: All the component parts specified are readily obtainable on the market through high-class dealers.

PARTS: The parts specified in this design are all selected with expert consideration with a view to giving the maximum results obtainable. While it may appear that certain other parts could be used to economize, we strongly recommend that you take advantage of our engineering experience and follow the specifications to the letter.

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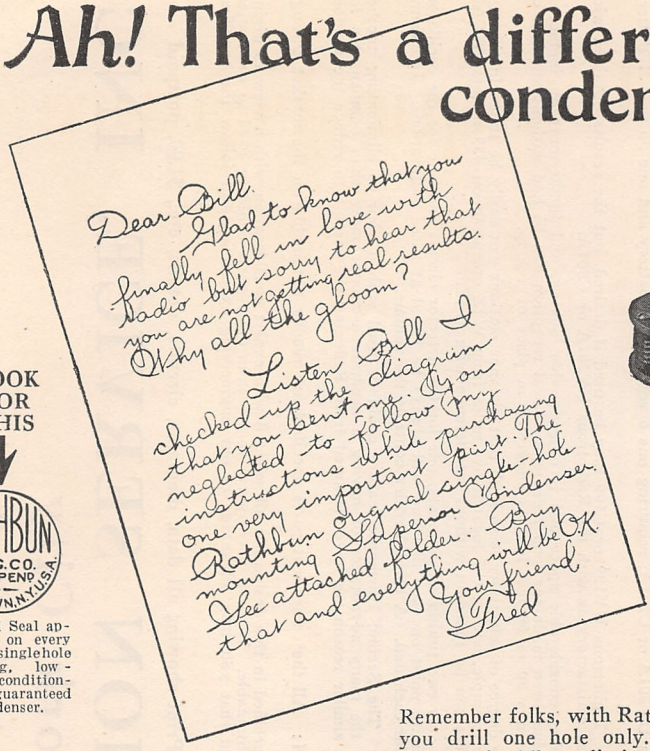

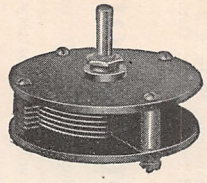

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Examine them at your dealers, or write (mention RADIO NEWS) for complete details. Prices "3 to 43 Plates"—$1.00 to $6.00. RATHBUN MANUFACTURING COMPANY, INC., Jamestown, N. Y.

RATHBUN SINGLE-HOLE MOUNTING
SUPERIOR CONDENSERS

A smoothly adjustable

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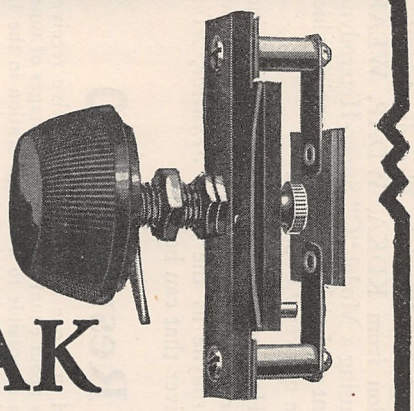

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grid circuit will be heaviest and the tube will not have the least tendency towards self-oscillation. If, however, L_1 and L_2 are very loosely coupled, the grid circuit will be almost free and the tube will readily oscillate. Even though L_1 and L_2 are tightly coupled, a detuning of the aerial circuit L_1 C_1 will be equivalent to moving the aerial coil away from the grid coil because when the aerial circuit is out of tune with the grid circuit the aerial circuit will not absorb energy from the grid circuit and will therefore not have any appreciable damping effect on it.

The loose coupled arrangement of Fig. 14 is not to be recommended where a number of stages of radio frequency amplification are employed, unless the methods of stopping self-oscillation are perfected.

The conclusions to be drawn from these remarks are to the effect that the Fig. 11 type of aerial tuning is the best for ordinary purposes where there is a plurality of stages of radio frequency amplification.

A Letter from Mah Jongg

(*Continued from page 674*)

should make there conshuntzes itch to even think of. My first proof is thusly!

1. When Hon. radio spout "Somebody Stole My Galena," do ohner of receive set know singsong is copywriting? Certainly no! I explode. If he do not, like it and reproduct it on set, do he wrong? Of course no! I shriek with emphasis. If copy write club desire pay for such song, I broadcast, they should insert warning in Hon. send station!

"Deer Lisseners,

The necks number on Hon. program are a song name "Yes, We Have No Apricot; Watermelons All We Got," by copywrite club. All fans who lissen, I snarl, will haft apay 40$ and sum odd sense." That, I snort, are fare warning.

But

Some fans, mix, have cristel sets. If Hon. send station produce copywrit songs only, poor fan hear nobody but songs which he pay for if possible. But he no have money. Then he no can run radio, which are cruel.

Then sippose pigly auther of song come to door and seigh, "Lass night you tune in on 'Why Did I Kiss Your Foot' and thusly owe me much $$$."

Then fan say, "I didn't. I were listening to Hon. W. J. Bryan talk about Laffolit."

Then what?

3. Also perhapsly fan lissen to table talker sing solo and hear no nownsment of hafta pay. Then spy of arther club come to door and say, "I hear you osculate certain song of sosiety lass night. Payme." Hon. fan cannot tell when song begin. If get it, I sneeze, in middle, how can know hasta pay?

If spy of profiteer club lurk in darkness to listerine songs, only he hear those which from the wide horn are loudly reproducted. That is not fair to people without such.

If prophiteer club of appropriaters make all fans pay, that are unfair to those who lissen if song are good, or those who hear it if it are bad. Then!

Because Sosighity for Securing Simolions cannot tell which fan listens to make him pay—— and maybe song are no worth any money at all yet——

Because fan with cristil set no can listen to any except if such are broadcasted——

Because no listener can tell if song is copywrote——

It are fare for song-scribbler to get unfinanced from fans.

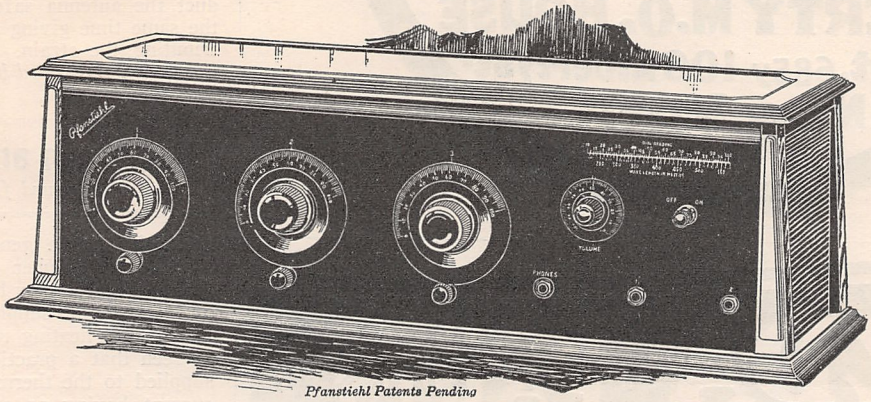
Who then should pay?

Hon. person who sing or play tune should pay! If tune are good, subscription are

Station Finder Is Unique Feature in the New Pfanstiehl

MODEL 7 RECEIVER

Simplest to Tune



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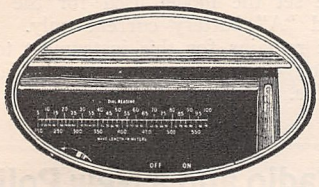
A 5-Tube Receiver using the new system of tuned radio frequency

How to Use the Pfanstiehl Station Finder



GUESSWORK in tuning is now eliminated. From the radio program in the daily newspaper ascertain the wave-length of the station you want to hear.

1. Find this wave-length on the lower scale of the Station Finder.

2. Read the number directly above it on the upper scale, and set each of the three large dials to this reading and you hear the station desired.

3. When securing extremely long distances, sharpen tuning by adjusting the large dials slightly, one at a time, with the small vernier knob below.

The Pfanstiehl Non-Oscillating System

SIMPLICITY of operation is made possible by an entirely new development in circuit design embodied in this receiver, the Pfanstiehl Non-Oscillating System.

Oscillations are the source of internal disturbances in radio frequency receivers. By means of shaping magnetic and electrostatic fields, Pfanstiehl has avoided altogether the generation of these disturbing oscillations. Hence, no devices to choke them down; such as potentiometers or neutralizing condensers, are needed. How much more effective it is, not to misdirect or waste forces, than to suppress them afterwards! It is also more efficient. Hence, the supreme purity of tone and sensitivity to distant signals in the new Pfanstiehl Model 7.

DEALERS: Exclusive local franchise open to strictly high-grade dealers in a number of desirable territories. Act quickly. Write for the Pfanstiehl proposition.

Pfanstiehl Radio Company, R. N. 2
Highland Park, Illinois

I am interested in building up my radio sales. Send me your exclusive dealer-agency proposition.

*Your Name*_____

*Your Address*_____

*Town or City*_____ *State*_____

Send For
FREE
RADIO
100 Pages CATALOG You Need it!
Crammed full of interesting information about radio and reduced-price offers on complete
Sets, Parts and Accessories
In answering will you please add the names of several persons you believe will soon want radio goods? Thank you.
LIBERTY M.O. HOUSE
Dept. 685y 106 Liberty St.
New York
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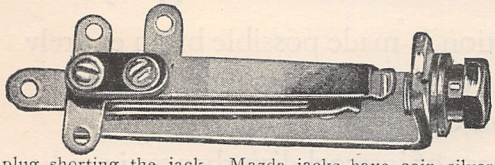
MAZDA RADIO PARTS

It's the Handiest Jack Made



Mazda jacks represent perfection in radio instruments. Terminals are located for convenience in making connections; strong heavy springs give a firm grip on the plug, and the plug stop prevents the possibility of plug shorting the jack. Mazda jacks have coin silver contact points which will not burn out. Narrow tongues reduce the capacity effect to a minimum. Plug guide requires only ⅜" panel hole. All Mazda jacks are carefully finished and nickel plated.

Open Circuit 50c. Closed Circuit 60c. Double Circuit 70c.
Filament Control Single Circuit 65c. Filament Control Double Circuit 75c.

Other Mazda Radio Parts Which We Manufacture

Condensers (6 sizes) 17 plate $2.50; 23 plate $3.00; 43 plate $4.00; Lock grip Triple Pull Socket $1.00. Rheostats (3 types) graphite pile $1.25. Filament switch 60c. Qualitone horn, single or double $3.50.

Potentiometer, 200 ohm $1.00. Plugs (two types) Mazda Perfection 60c. Contact Switch lever 30c. "Consomello Grand," a six tube tuned radio frequency receiving set.

IF YOUR DEALER DOES NOT STOCK MAZDA PARTS WRITE US DIRECT.

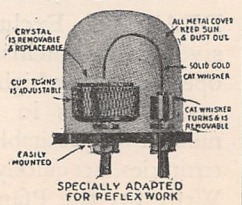
THE MAZDA RADIO MFG. CO.
3405 PERKINS AVE. CLEVELAND, O.

Manufacturers of Radio Parts (No Sets)

As large Wholesalers only and carrying stock in eight largest Cities in Australasia, we can give standard Lines exclusive representation. Send us your catalogue; and samples by Parcel Post, which we will pay for or return.

UNITED DISTRIBUTORS Ltd.
Sydney, Australia
Cable Address; "SUPERIOR"
References: United Manufacturing & Distributing Co., 9705 Cottage Grove Ave., Chicago, Ill.

The "LINCOLN"
Enclosed Fixed Adjustable Detector
Kills your Reflex Troubles
New List Price $1.50



SPECIALLY ADAPTED FOR REFLEX WORK

Manufactured by
The LINCOLN MFG. CO.
Dept. E. 1 LOS ANGELES, CAL.

raised for benefit his widow when he die if any. If tune are bad he should be excited he are not lynched.

So if cash collecter appear at my door I notify Hon. Insane Islylum and greet collector tenderly with red hot radiator on bean.

Your Sincearly
MAH JONGG
Ceocutt, Phlorida.

A Simple Aerial Support

(Continued from page 703)

jecting in the air will determine the space between the two aerial wires, if two strands only are desired.

Connecting the two ends of the cross pieces as shown by the dotted lines will form a support for the transmitting aerial of as many strands as desired.

A cross arm bearing insulators will conduct the antenna safely by the chimney at the same time giving added support and distributing the strain.

Contributed by Willis H. Farnum.

D.C. from an A.C. Source

(Continued from page 687)

electricity to be generated. By arranging a sufficient number of these couples, any desired voltage may be had. Since the ratio of line current supply to the heat rise and fall of the heating unit is so great, it will be seen that a practically even heat will be supplied to the thermo-couple units. Direct current having no pulsations, is thus generated.

A test, recently made with one of the experimental models, showed that it was possible to supply filament current to all tubes of a six-tube Super-Heterodyne set without the slightest ripple resulting. Although it is possible to supply all the current necessary for the operation of a multi-tube set the model used for the test supplied "A" battery current only.

It remains for this instrument to be perfected when it will be commercially practicable.

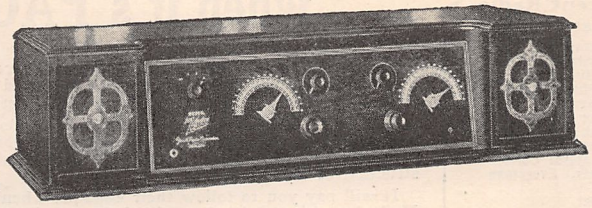
Radio and a New Political Era

(Continued from page 673)

been good for the people. We are so deluged with print in modern times, and are kept so much from a sense of actuality and personal contact by reason of the cold, lifeless type-lines, that our political muscles or faculties have seemed to atrophy. We badly needed a rejuvenation by means of a miracle which would restore us, *en masse,* to a personal contact with politics. This the radio miracle now accomplishes; and it must perforce mean a new political era.

Recently there was tested the new DeForest device for synchronizing moving pictures of candidates speaking with the voice coming over the radio. If widely adaptable and reliable in broader practical tests, this will give another miraculous twist to the new political era. We shall *see* as well as hear, thus employing two senses instead of one; making radio appeal to *one-third* of our senses instead of one-sixth.

We may look for the renaissance of the cracker-barrel philosopher, and he needn't sit on the sugar barrel of the village store to perform, either; he can gather a few of



Super-Zenith VII

(Not regenerative)—6 tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—44⅞ inches long, 16¾ inches wide, 10⅝ inches high. Door panels inlaid. Slanting panel of sheet bronze, mahogany finish, with scales and indicators in metallic relief Gold plated pointers, to prevent tarnish. Compartments at either end for dry batteries. Can be operated on either wet or dry batteries. Either inside or outside antenna.

Price (*exclusive of tubes and batteries*) $230

Super-Zenith VIII

Same as VII except—built with mahogany legs of well-proportioned appropriate design, converting model into console type.

Price (*exclusive of tubes and batteries*) $250

Super-Zenith X

New and exclusive Zenith features make this model supreme in the field of Radio. See Super-Zenith X at the Radio World's Fair, Madison Square Garden, New York, September 22nd to 28th.

Price (*exclusive of tubes*) $550

Super-Zenith IX

Same as VII except—built with legs and additional compartments containing built-in Zenith loud speaker on the one side and generous storage battery space on the other.

Price (*exclusive of tubes and batteries*) $300

It Tunes Through *Everything*

The New SUPER-ZENITH

The new Super-Zenith is NOT regenerative. It is a six-tube set in four different models ranging from $230 to $550, with a new, unique and really different patented circuit controlled exclusively by the Zenith Radio Corporation. Amplification is always at a maximum in each stage for any wavelength. *The Super-Zenith line is not affected by moisture.* For the first time, you have here a set that—

1—tunes through *everything* and selects the station you really want.

2—requires only *two* hands—*not three*—to operate.

3—brings in each station *at only one point on the dial.*

4—affords such mathematical precision and simplicity that you can run over the entire dial in 1½ minutes and pick up *more* stations with greater clarity and volume than any other set on the market. Direct comparisons invited. The new Super-Zenith was perfected in Zenith's laboratories in the center of the eleven powerful Chicago broadcasting stations. Even under these extremely adverse conditions the new Super-Zenith tunes through everything and "gets the outside" on loop, inside, or outside antenna.

5—produces not only the seemingly impossible in perfect selectivity, but also possesses such artistry of design, such finished craftsmanship, that it lends distinction and exclusiveness to any living-room or library.

Write for the name of the nearest dealer from whom you can obtain a demonstration of this outstanding marvel of the radio world.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise.

ZENITH RADIO CORPORATION

332 South Michigan Avenue, CHICAGO 1269 Broadway, NEW YORK

ZENITH

Super-Zenith X
Exclusive Features

Contains two new features superseding all receivers. 1st—Built-in, patented, Super-Zenith Duo-Loud Speakers (harmonically syncronized *twin* speakers and horns) designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, distinctly a Zenith achievement. Requires no A or B batteries or charger.

Zenith Radio Corporation
Dept. 11B
332 S. Michigan Ave., Chicago, Ill.

Gentlemen: Please send me illustrated literature giving full details of the Super-Zenith.

Name.....

Address.....

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ZENITH—the exclusive choice of MacMillan for his North Pole Expedition. Holder of the Berengaria record.

You'll be proud of your set— when it's PACENTIZED

Pacent Radio Essentials

Adapters
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Jack Set
Loops
Loop Plug
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Plugs
Potentiometers
Rheostats
Resistances, Cartridge
Sockets
Twin Adapter, etc., etc.

To get the maximum of selectivity, distance and volume from your home built radio set it is necessary to use good parts. Use quality parts in building and you will have a set that is better than your neighbor's.

The most successful manufacturers of radio sets do not stake their reputations on inferior parts. It comes to you direct from over 30 of the leaders, all of whom are using Pacent Radio Essentials in the construction of their sets.

It will pay you to follow their example when you build your next set. Made by pioneers in the radio industry, Pacent Radio Essentials cost no more than inferior parts—and they can be counted on.

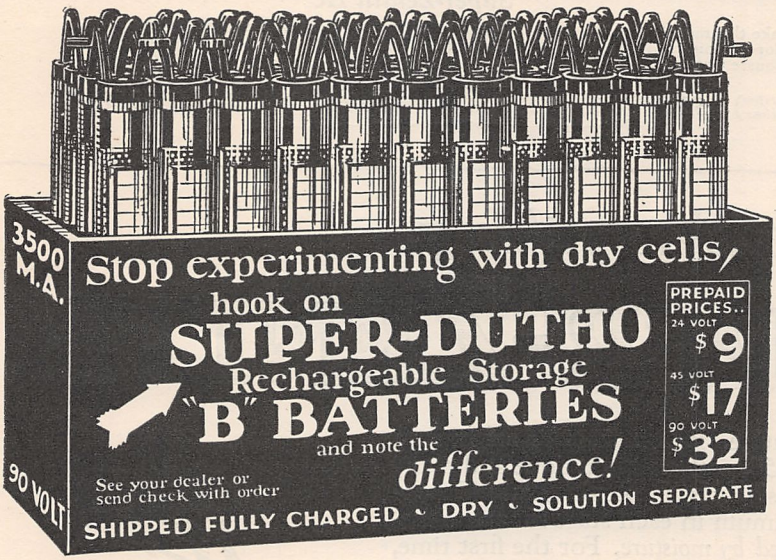
If your favorite dealer does not carry Pacent Radio Essentials he can easily get them for you. The complete Pacent catalog W-10 illustrating over twenty Pacent parts, will gladly be mailed upon request.

"Don't Improvise—Pacentize"

Pacent Electric Company, Inc.
22 Park Place, New York City
Washintgon, Minneapolis, Boston, San Francisco, Jacksonville, Chicago, Birmingham, Philadelphia, St. Louis.

See our exhibit at the FIRST RADIO WORLD'S FAIR. Madison Square Garden, September 22-28th, 1924.

Pacent
RADIO ESSENTIALS



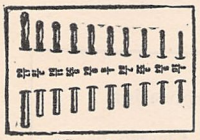
Dealers—Write for special proposition

DURKEE-THOMAS Products Co.
1228 Folsom Street, San Francisco, California

Write for booklet on Storage "B" Batteries

(708)

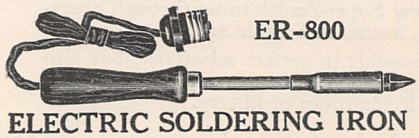
Use "RAGEMCO" Tools to Build Better Radio Sets



ER-305 RADIO DRILL SET

Composed of 10 straight shank twist drills, fitting all hand and breast drills. The selection of these drills has been especially made for Radio Constructors and consists of the following sizes: 1-16, 5-64, 3-32, 7-64, ⅛, 9-64, 5-32, 11-64, 3-16, 17-64. Drills are mounted on white Holland Linen with sizes clearly marked.

ER-305—Price $1.25



ER-800

ELECTRIC SOLDERING IRON

A perfect tool for Radio Work. Operates either on 110-volt A.C. or D.C. The heat element is of Nichrome, which prevents overheating and assures the desired even temperature. Size of Iron, 10½ in. long. A 4-foot cord and plug is furnished.

ER-800—Price $2.00

Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list.

THE RADIOGEM CORP., - - 66-R-W. Broadway, New York City

his cronies around his own fireside of a wintry night, far from the village store. They tell of sections of the country where the isolated farmers still vote for Andrew Jackson; and Lulu Volmer in her Tennessee mountain plays has depicted those who during the World War did not even know there was a war. In a day when even the peons of Mexico, far up in the mountains, are listening to radio, there is little excuse for backwoodsmen being without radio. Canadian lumbermen in the trackless wilds heard Davis accept the Democratic nomination and heard the fall of Senator Walsh's gavel in Madison Square Garden. Where, then, is there room for political ignorance?

I rate the interest of youngsters in politics, via radio, as of very high significance. While only a percentage of them will tune in, I am sure many young men and women both will "get the feel" of politics, and perhaps lose that peculiar horror which many people seem to have about politics.

Much depends on the sagacity of the public broadcast station managers this fall in refusing to make a dreary mess of political speeches. Radio audiences will be even more shy of bores than political meetings, when it is often impossible to go out if you don't like the oratory. Snap! goes the radio switch and the radio political orator is wafted into oblivion. Therefore much wisdom is due from wise campaign managers who will develop a type of radio oratory fitted to the medium and the volatility of the audience. No cart-tail technique goes on the radio; somehow its low-brow absurdity sticks out of it at once. We will need less oratory, more fact, terse sentences, more winning and less raucous voices.

The Heterodyne Wavemeter

(*Continued from page* 693)

wave. Now reduce the wavemeter condenser capacity, as explained above, and take the necessary readings. Do the same for the third harmonic of the receiver, leaving the latter in its original adjustment the whole time. We cannot make use of the third harmonic on waves shorter than 180 meters because the wavemeter will not go down far enough. Nevertheless a sufficient number of points can be obtained to plot a very good curve, and if the measurements have been carefully made, its regularity will be surprising to those who perform the experiment for the first time. The graph paper should permit plotting to two places and estimation to a third.

It may seem a disadvantage to have the minimum wave-length as high as 60 meters when waves as low as 20 meters may now be used. It should be borne in mind that the wavemeter emits harmonics also. For example, when adjusted to 60 meters it also emits waves of 30 and 20 meters. Those of higher frequency than this are not of much use because they are too weak. We can make use of the second and third harmonics by having a receiver that will go down to 20 meters. We will at least be able to tell to what wave a transmitter is tuned. This is about all that is necessary at these short wave-lengths. For other work, such as condenser calibration and inductance measurement, it is desirable to use lower frequencies because the likelihood of error is much less. This subject will be covered later.

The second installment of this article will appear in a forthcoming issue.

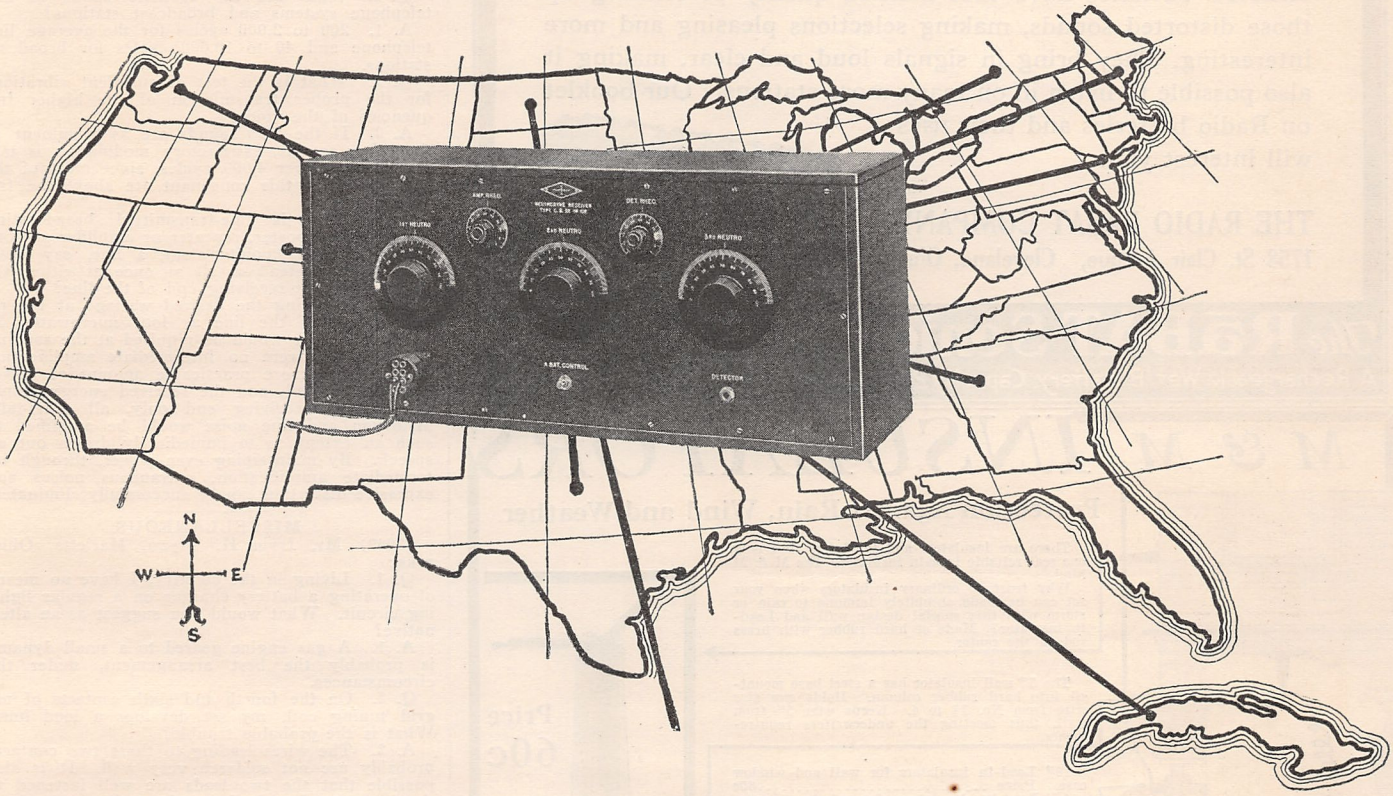
WOOD WHAT? WOULD METER

"If a tube went out, would the lightning arrester?"

"No, but the cabinet wood."—*Clifton Ask.*

How is this for a record!

Illinois fan gets 210 stations with the Murdock Neutrodyne



THIS Dwight, Illinois, fan says: "I got my Murdock Neutrodyne in the latter part of January and have had 210 stations, 24 of them over 1000 miles distant. I have had Porto Rico, two stations in Cuba, Mexico City, Portland Oregon, and six stations in Canada: Regina, Calgary, Winnipeg, Montreal, Toronto and Ottawa . . . .

"I have been able to get Havana when a super-heterodyne could not pick it up. I have also picked up about 50 amateurs, and got stations in low wave-lengths that no one else here seems to get. . . "

Licensed by Independent Radio Manufacturers Inc. Reg. U.S. Pat. Off. NEUTRODYNE Pat. March 27 1923 and April 1, 1924. Hazeltine Pats. Nos. 1,450,080 and 1,489,228. Other Patents Pending.

A superb radio investment

WITH the Murdock Neutrodyne you have at your command a great range. You receive local and distant stations with wonderful clearness and volume — and without interference. Easy to operate, selective, handsome in appearance—the Murdock is one of the best receiver values on the market.

Let your dealer demonstrate the Murdock Neutrodyne for you. Absolute satisfaction is guaranteed.

RADIO MURDOCK

WM. J. MURDOCK CO., 368 Washington Ave., Chelsea, Mass.

Branch Offices: New York, Chicago, San Francisco

MURDOCK RADIO PRODUCTS

Standard since 1904

Send for this free booklet

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368 Washington Ave., Chelsea, Mass.

Gentlemen:
Please send me, without obligation, your Free Booklet describing the Murdock Neutrodyne Receiver.

Name .....

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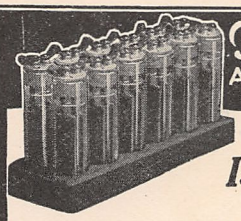


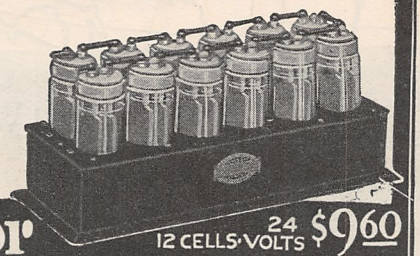
The RāBAT Junior $3.96
A Rechargeable Wet 'B' Battery. Capacity 800 Mil-Amps.
12 CELLS 24 VOLTS

Is Your Set Giving Satisfaction or Is It Badly Handicapped?

Poor or weak batteries will reduce the efficiency of any Radio Outfit, causing annoying noises which make clear reception impossible.

RABAT batteries have that marked quality of clearing up those distorted sounds, making selections pleasing and more interesting. They bring in signals loud and clear, making it also possible to listen in on many more stations. Our booklet on Radio batteries and their uses will interest you.

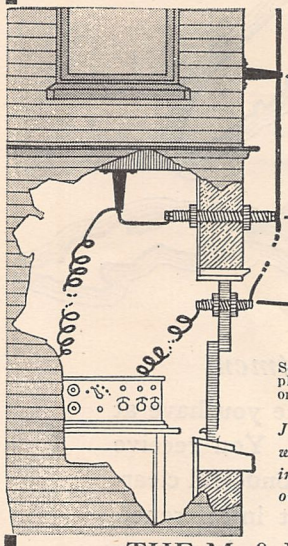
THE RADIO RABAT COMPANY
1758 St. Clair Avenue, Cleveland, Ohio



The RāBAT Senior 24 $9.60
12 CELLS-VOLTS
A Rechargeable Wet 'B' Battery. Capacity 2800 Mil-Amps. 48 VOLTS $17.88

M & M INSULATORS

Protection Against Rain, Wind and Weather



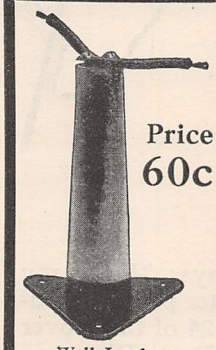
There are insulators and insulators, but only one real reliable lead-in insulator—The M & M kind.
Why trust to ordinary insulators when your set can be made absolutely immune to rain or storm with this special design wall and Lead-in insulator? Made of hard rubber with brass rod in the center.

The 5" wall insulator has a steel base mounted into hard rubber column. Holds any size wire from No. 14 to 4. Keeps wire 5" from wall, thus meeting the underwriters requirements.

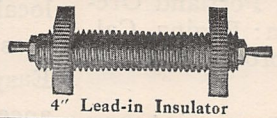
10" Lead-in insulators for wall and window case. Price 80c
4" Lead-in insulators for window frame. Price 50c

Send for radio catalogue. We have a complete line of sets, parts and supplies. Mail orders shipped promptly.

Jobbers and Dealers. Last year we were swamped with orders for M & M insulators. Protect yourself by placing orders immediately.



Price 60c
Wall Insulator



4" Lead-in Insulator

THE M. & M. COMPANY
500 PROSPECT AVE. CLEVELAND, OHIO

Increase your Range

From 15 to 100 per cent

You *can*, with your present equipment, by using SPRINGFIELD 16-STRAND BRAIDED ANTENNA.

Most wonderful wire for indoor loops. Its extra large surface—twice that of ordinary wire—enables you to get greater distance and clearness.

125 feet in your attic, in strands 3 feet apart, gives better results than 150 feet of ordinary wire outdoors. *Write for free booklet.*

At dealers—or send us $2.50 for 100 feet.

Dealers and Jobbers—write for prices and terms.

SPRINGFIELD WIRE & TINSEL CO.
67A Taylor St. Springfield, Mass.
New York Office: 51 E. 42nd Street
Tel. Vanderbilt 5090

Springfield 16 Strand Braided Antenna

I Want to Know

(*Continued from page* 712)

If batteries are external, the leads should be run in conduit and this conduit grounded to "A" negative, or to ground. It may be advisable to change the plane of the transformer windings.

Q. 3. Knowing the diameter of one strand of wire, how can the diameter of seven strands be figured?

A. 3. The diameter of a single strand of wire, multiplied by three, equals the diameter of a seven strand cable, using the same wire.

ACOUSTICS

(2048) Mr. John F. White, Jr., Boston, Mass., writes:

Q. 1. What are the acoustic bands of line telephone systems and broadcast stations?

A. 1. 200 to 2,000 cycles for the average line telephone and 40 to 10,000 cycles for broadcast stations.

Q. 2. What is the test of sufficient vibrations for the proper transmission of the higher frequencies of the voice?

A. 2. If the "S" sounds are as prominent as the other sounds, satisfactory modulation is taking place at over 4,000 cycles, since most of the components of this consonant are above the frequency.

Q. 3. Why is line-transmitted broadcasting amplified by booster, repeater or amplifier stations placed at many points along a line, say 1,600 miles long, instead of all at once at either the transmitting, or receiving end of the line?

A. 3. Figuring the desired wattage at the receiving end of the line as four microwatts, 30 billion kilowatts would be required at the sending end, if there were no intermediate amplification points. If a more practicable amount of power were transmitted, and the received energy amplified at the receiving end only, all cross-talk, distortion and line noise would be amplified to such an extent as to immediately drown out all speech. By maintaining even power, through intermediate amplification, extraneous noises and excessive distortion can be successfully eliminated.

MISCELLANEOUS

(2049) Mr. Irvin H. Tryon, Marietta, Ohio, asks:

Q. 1. Living in the country, I have no means of operating a battery charger on a regular lighting circuit. What would you suggest as an alternative?

A. 1. A gas engine geared to a small dynamo is probably the best arrangement, under the circumstances.

Q. 2. On the fourth and sixth contacts of my grid tuning coil, my set develops a loud hum. What is the probable trouble?

A. 2. The wires leading to these two contacts probably are not soldered very well. It is also possible that the two leads are well fastened to the contacts, but broken where the coil tap-off is taken.

Q. 3. With aerial and ground off, and the "A" battery disconnected, a scratching sound can be heard. What is its cause?

A. 3. This can be caused by a partial short circuit between the plate and "B" negative. A partly conducting socket is the usual explanation.

CORRECT RHEOSTAT

(2050) William H. Pepper, Stratford, Ont., Canada, requests:

Q. 1. What is a general rule for rheostat resistance, when using several tubes of the same type on the correct current supply?

A. 1. Use one-half the regular resistance, when using two tubes, one-third when using three tubes, etc.

Q. 2. What are the correct rheostat resistances for UV-199, UV-201A, UV-201 and WD-11 type tubes?

A. 2. Use a 30-ohm rheostat for UV-199 tubes, on a 4.5-volt circuit; 25 ohms for UV-201A tubes on a six-volt circuit; six ohms for UV-201 tubes on a six-volt circuit, and six ohms for WD-11 tubes on a 1.5-volt circuit.

Q. 3. What are the specifications of the UV-303, 50-watt power tube?

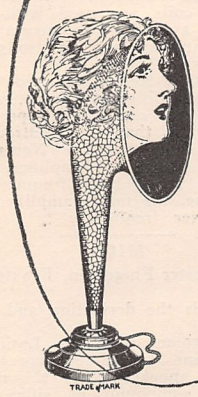
A. 3. Filament supply voltage, 12 volts; 6.5 amperes consumption; normal plate voltage, 1,000 volts; normal plate amperage, .15 amperes; amplification constant, 10; 50 watts normal output. A special socket is required.

NON-REGENERATION

(2051) Mr. T. G. Smith, Southingtown, Conn., asks:

Q. 1. I have a three circuit tuner using secondary condenser and plate variometer. The tube will not oscillate when condenser scale is above 50, or about 450 meters. Will you kindly tell how to correct this?

A. 1. Vary the grid leak and "B" battery voltage. Connect a fixed condenser across the plate variometer, by means of an off-on switch. A capacity of .00025 to .0005 mfd. will be about right. Since you did not state your variometer settings at the highest point of oscillation, we must guess at the causes of non-oscillation. Be sure you have a phone condenser. Its capacity



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TRADE MARK

RADIO REPRODUCTION speaker

ATLAS floods the room with the best that's in your set. Write for the interesting booklet you ought to read before buying *any* speaker.

Multiple Electric Products Co., Inc., 36 Spring Street, Newark, N. J., Dept. F. New York, Boston, Philadelphia, Baltimore, Pittsburgh, Detroit, Chicago, St. Louis, Denver, 550 Howard Street, San Francisco.

Marconi Wireless Telegraph Co. of Canada, Ltd.
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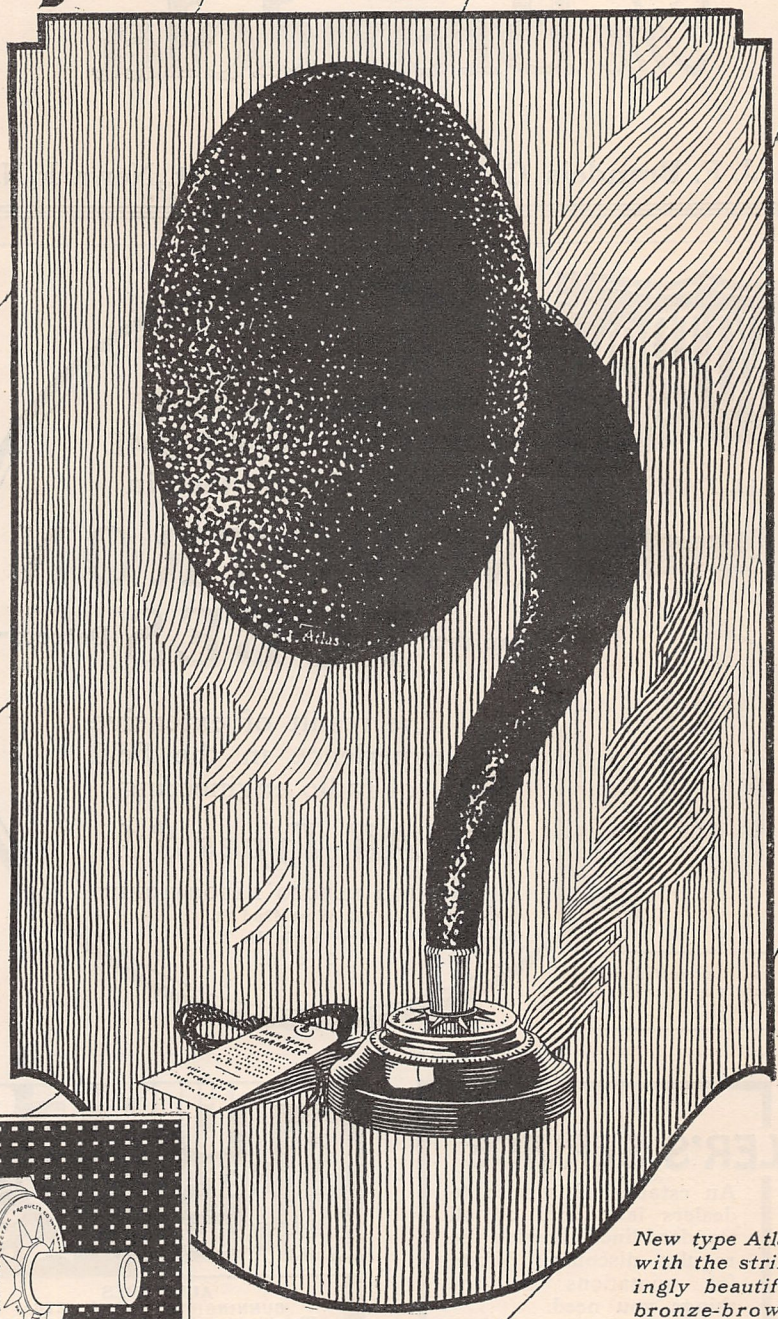
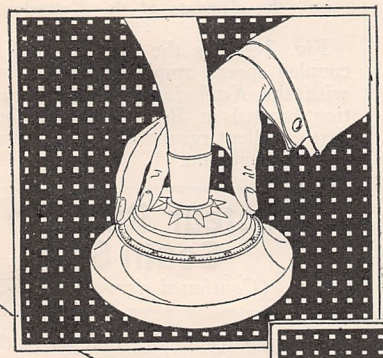
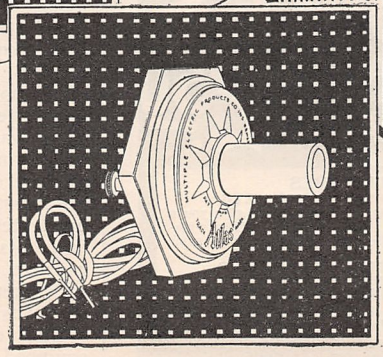


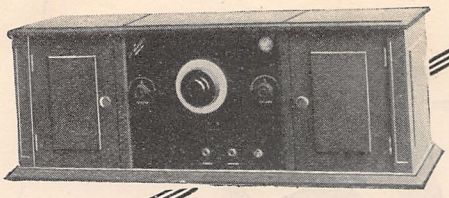
New type Atlas with the strikingly beautiful bronze-brown ripple-finish gooseneck horn.



A slight turn of the exclusive Atlas harmonizer (Pat. applied for) — and your speaker is harmonized with the broadcast you are hearing and the set you are using. It gives you radio—as you ought to hear it.



Atlas unit, with attachment couplings to fit all standard phonographs.



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Just one dial to adjust—so simple that a child of six years can tune in local and distant stations with the same ease and confidence as its parents—a simple adjustment of the one dial and you may choose between the many programs in the air.

LIST PRICE $125.00

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The J. F. Brandeis Corp. 36 Oxford St., Newark, N.J.

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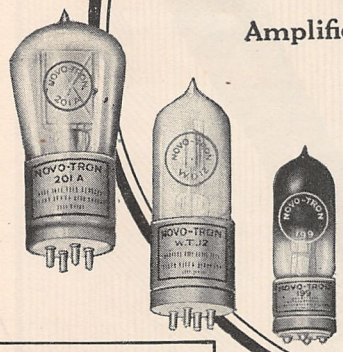
ALL TYPES

The Three Essentials
LIFE, TONE & VOLUME
are Fully Guaranteed in

NOVOTRON TUBES

Amplifier Detector



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TUBES REPAIRED AND EXCHANGED $2.50

ALL TYPES
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We will either repair your tube or give you a brand new tube at the same price. Price without old tube, $2.75. All tubes shipped same day order received.
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RADIO TUBE HOSPITAL
206 BROADWAY Department N NEW YORK
Cor. Fulton St., Room 418

may be about .001 mfd. A larger variometer may remedy the trouble.

Q. 2. In reference to the Ultradyne, does mention of coils L1 and L2 mean that they are not required when the loop or when aerial is used?

A. 2. These coils are used with an outside antenna only, as a study of the diagram will show.

Q. 3. In what way is a Neutrodyne different from a Heterodyne?

A. 3. The Super-Heterodyne type of receiver employs an entirely different principle of reception, from the Neutrodyne sets. The Super-Heterodyne requires more tubes than the Neutrodyne and is, therefore more sensitive. The Neutrodyne is a form of radio frequency amplifier, where the amplification is at a high frequency. In the Super-Heterodyne, the major amplification is at a considerably lower frequency.

MICA

(2052) Mr. Lester Fingerson, Feaxton, N. Dak., requests:

Q. 1. What is the derivation and composition of Mica?

A. 1. Mica comes from the Latin, "micare," meaning to shine (a name suggested by the naturally shiny appearance of the mineral). It is a complex compound of silica, potassium, sodium and magnesium. "Muscovite" is its correct name.

Q. 2. Is all mica good as a high grade insulator?

A. 2. Not all mica is satisfactory for insulating purposes. If pin-holes or iron oxide are in the mineral, its insulating value is greatly reduced. Iron oxide shows up as a reddish discoloration.

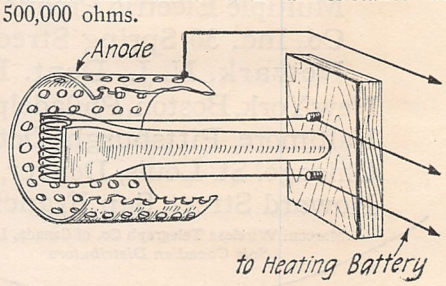
Q. 3. Is there any name for the peculiar layer separation of mica?

A. 3. This is called "basal cleavage."

The Microphone Without a Diaphragm

(*Continued from page 663*)

and anode (the perforated metal tube surrounding the cathode) the distance of which can be altered by means of a micro-adjustment nut. The fluctuation of potential due to the influence of sound waves is about 50 millivolts. It was found advantageous to shunt the ionized air path between the cathode and anode with a resistance of 500,000 ohms.



Arrangement and physical characteristics of the elements of the Kathodophon.

Fig. 2 shows the capacity and resistance coupled speech amplifier used in conjunction with the *Kathodophon* in a broadcast station located in Berlin. It has been stated that excellent results have been obtained with this combination.

Amateur Radio in the South Seas

(*Continued from page 675*)

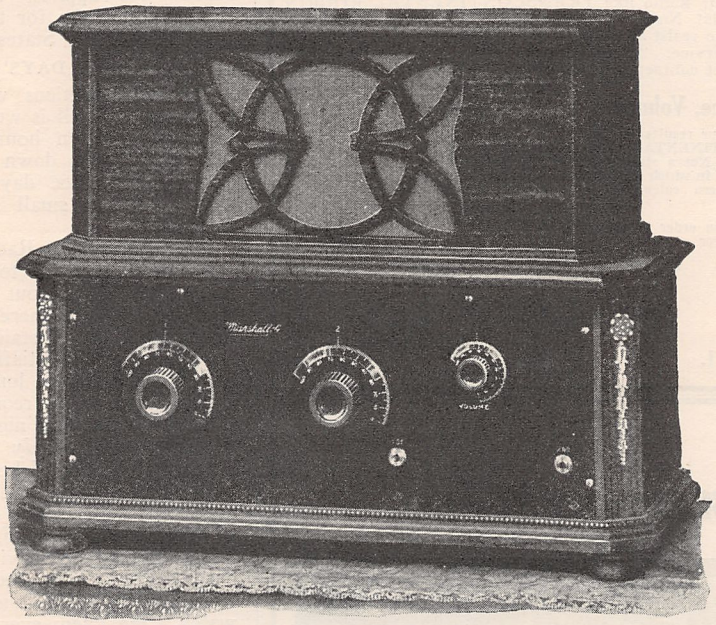
that Father Deihl ill, Aleipata, with appendicitis; requests you send assistance."

ROB were my call letters and DUM were those used by Apia Radio when carrying on tests with Father Dumas. The message was clear. Father Deihl, a fellow countryman, was ill at Aleipata and needed assistance. But how did Father Dumas get his message to Apia Radio? We had communicated over short distance by breaking into dots and dashes, the continuous waves radiated by our aerials when the tubes in our regenerative sets were oscillating. Aleipata was too far away for this method.

The relief expedition was organized and equipped. My wife, an ardent radio fan

Marshall 3-4 and 5 Tube Sets

The Greatest Advance yet made in RADIO



Solid Mahogany Cabinet of unique and artistic design

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This Beautiful Marshall 4 Tube Non-Oscillating Receiver

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Complete with all accessories

WRITE TODAY for full particulars of this most exceptional offer. Marshall Sets embody the very latest improvements known to radio. They are licensed under Pfanstiehl Patents Pending, and utilize the wonderfully efficient Pfanstiehl Non-Oscillating System. This discovery of Carl Pfanstiehl is the big sensation of the 1924-25 radio season. It brings the first real improvement over the Neutrodyne, Superhetrodyne, Regenerative, and Reflex circuits. It is positively non-regenerative. It brings to radio a new degree of musical quality. Its selectivity will delight the experienced radio operator. Yet it is so easy to tune that the novice will handle it like an expert.

Easy Monthly Payments—*2 Weeks Free Trial*

This is the remarkable offer we are prepared to make you! Two weeks to prove that the outfit you select is everything we have said for it. If it doesn't make good our claims, back it comes, and your deposit will be cheerfully refunded. But if it fulfills all your expectations, you may pay for it in easy monthly installments. You don't risk a cent when ordering from us. You *must* be satisfied, or we don't do business. Is it any wonder that radio buyers the country over are rushing to take advantage of such an offer? If YOU are interested, figure on getting your order in early, while prompt shipment can be made. Everyone predicts a serious shortage of radio supplies this season. Send for full particulars today.

Beautiful Solid Mahogany Cabinets

Just compare the beautiful outfit pictured above with the usual radio box and horn! The speaker cabinet appears as part of the combination unit. Designed by a master designer—fashioned of the finest solid mahogany, it will harmonize with the furnishings of the finest homes. Yet through our different way of merchandising, this exceptional cabinet value—plus the unequalled mechanical qualities of the Marshall Set—plus easy terms—costs you actually less money than the ordinary sets sell for on a cash basis.

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In buying from Marshall, you have the choice of a set complete with all accessories, or the set alone. You have choice of dry cell or storage battery outfits. Unless you already own the accessories, you can buy them from us at less-than-market prices, with your set, on easy terms. Your outfit will come all ready to set up and operate within a few minutes,—saving time and trouble—and saving money, too.

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If you have any idea of buying a radio set this year, don't let this chance slip by. Our terms and liberal guarantees have set a new pace in the radio business. The low prices we will make you on a 3, 4, or 5 tube Marshall set will surprise you. A letter, postcard, or just coupon will do. But send it today.

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Please send me your special offer price, terms and full description of Marshall Radio Outfits. Though I may change my mind on receiving your proposition, my preference now is for a:

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Take the word of a million satisfied users for it—there's no other type of aerial that brings out the possibilities of your Radio like TRANSCONTINENTAL RIBBON Aerials! Now improved 3 ways: 1. *Waterproof enamelled*—to resist all weather and give you year in and year-out service. 2. *No-solder fastening* means permanently perfect contact. 3. *Adjustable* for length.

50 Ft.	$1.75
75 Ft.	2.50
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Better Tone, Distance, Volume!

Don't blame your receiver if your results are below par. Change to TRANSCONTINENTAL Ribbon Aerials and change your luck! Not a strip of flat copper, but a laboratory product, in which resistance, capacity and strength have been calculated and standardized.

If your dealer cannot supply you order direct from the manufacturer.

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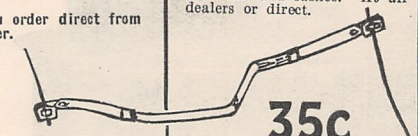
Little bother of the aerial. Enamelled to resist weather. Triple insulated Fahnestock clips at both ends. Saves drilling walls and sashes. At all dealers or direct.



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a Booklet that describes this Peer of all Receivers and a larger Laboratory model in plain, non-technical language. The detail drawings and photographs make it possible for anyone to build the set, and secure the results that have amazed Engineers. Send for your copy at once. **Price 50c**

at last— the *portable* super-heterodyne

PERFECTED

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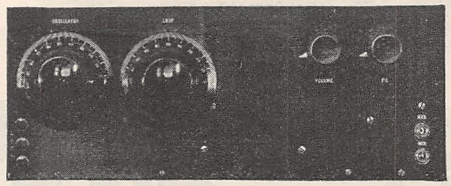
AUTHORITIES

on Radio have declared it to be an "ELECTRICAL MASTERPIECE." It secures results you never hoped to obtain outside of a Laboratory, and is so simple that you can construct it with a pair of Pliers, a Screw Driver and a Soldering Iron.

THE PARTS

recommended by Mr. Silver include a drilled and engraved Panel, and everything necessary to build the set. Price $58.00 Parcel Post prepaid, East of Rockies. (Accessories not included: Tubes, Batteries, Cabinet, Loop, Loud Speaker).



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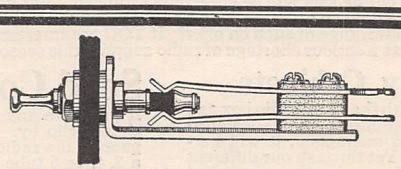


APPROVED RADIO NEWS LABORATORIES 1922

The Adams Perfected Battery Switch

Large current carrying capacity with heavy phosphor bronze springs and brass bushings—an extremely valuable feature which makes it adaptable equally well to the large or small set. This switch is self-cleaning. Corrosion or interference is impossible as the continued wiping action insures a perfect contact at all times.

A trouble proof switch. Unconditionally guaranteed.

Write for radio parts circular.

THE ADAMS RADIO MFG. CO.
1044 West Van Buren Street Chicago

and an experienced surgeon, collected the surgical supplies. Two large mail bags of knives, saws, needles, pliers, pincers, drills and probes were packed. Yards of bandages, bottle after bottle of medicine and abundant supplies of ether and chloroform were added. An operation was probable.

I assembled the radio supplies. They consisted of audio frequency amplifiers, a fully charged storage battery, three vacuum tubes and "B" batteries. Excessive humidity breaks down transformers, tubes burn out and batteries deteriorate in Samoa. Father Dumas was sending his storage battery by boat to be charged. Radio fans in this part of the world can not step over to the nearest shop for supplies. When equipment goes, they wait months for their orders to arrive from the United States.

FIVE DAYS' RATIONS

Five days' rations were included in the equipment. If all is well the boat can make the trip in seven hours. Recently one of the boats broke down outside of Aleipata and drifted three days without food and water under a small sail, trying to make the land.

Mr. Dunwoodie, Radio Officer of Western Samoa, came in to join the expedition. He wanted to test out a new telephone for Aleipata. While there he could make arrangements for installing the transmitter, should it work satisfactorily. The radio officer contributed a long wave receiver and a two stage radio frequency amplifier.

At 10 o'clock at night we embarked on the motor ship *Lady Jane*, a disreputable little copra cutter of less than 10 tons. The five by five hatch cover was our bed, deck chair, and table. The dwarfed skipper was of mixed Malay and Fiji Island blood. He knew nothing of navigation, sextants and chronometers. He steered by his compass, the outline of the land, and a Waterbury watch. He knew every foot of the reefs, every turning of the coast line, and the exact moment to attempt to shoot through the passages.

There was little of the romantic about our departure. Others in the South Seas have sung of the balmy breezes, the garlands of flowers, and the sad strains of Aloha or Mai Feleni floating across the water. The only friend to wish us bon voyage was the manager of the trading company who tossed £1,000 in silver for his Aleipata stations on our hatch cover. The land breeze drove a chill mist down on us. The only music that accompanied us on our voyage was the grunts of the crew as the captain stirred them with his toe.

PUTTING OUT

In the early morning hours we were off the rugged iron bound coast, where the reef disappears. High cliffs rise up out of the ocean. The surf smashing against the lava walls has eaten its way through the lower strata into subterranean caves. The pressure of water underneath has blown holes through the upper layers of the cliffs. The water rushes into the caves and spouts into the air through the blow holes as geysers. Island mariners shun this part of the coast, for men and vessels soon pound to pieces on the jagged rocks.

Our engine missed a stroke, then another, and stopped. The captain grabbed a torch and a hammer. "Don't be afraid," he reassured us, "I'll soon have the engine going." For 10 minutes he busily wielded the hammer below. The roar of the crashing waves grew louder. The cliffs looming up in the obscurity of the early morning looked more sinister. The current was drawing us in to the shore. We knew the waters teemed with sharks. We thought we could see them astern following us to the shore. Our exhaust coughed spasmodically, then settled down to steady work. "By Jove," Dunwoodie remarked, "it's lucky we had a hammer aboard or VMG would be sending

The new Exide six-volt "A" Battery in one-piece case. Price, $14.60 up, f. o. b. Philadelphia.

An even better "A" battery *and at a much lower price*

IF you are one of the thousands who have come to rely on the famous six-volt Exide "A" Battery, you will not recognize the new one when you first see it — but you will know it when you hook it up to your set, for it has the same old rugged power, the same constant efficiency, and the same long life.

You will say of this new battery: "Handsome is *and* handsome does." The composition case (including handles) is moulded in one piece. Beautifully stippled and finished in glossy black, it is an ornament to any room.

Broad inter-cell connectors fit close to the top of the battery. Offset terminal posts make it very easy to hook up. Filling plugs require but a quarter turn to remove. This new Exide is made in five sizes — 50, 75, 100, 125, 150 ampere hour capacity.

Exide
RADIO BATTERIES

A complete line of radio batteries

If you use low-voltage tubes you have your choice of those sturdy midgets, the Exide two- and four-volt "A" batteries, weighing but five and six pounds.

In addition to the compact 24-volt Exide rubber case "B" battery of 4000 milliampere hour capacity there is the new Exide for those who desire visibility as well as capacity. This "B" battery is assembled in glass jars and is made in 24 and 48 volt sizes. Larger plates and greater space for the electrolyte give a capacity of 6000 milliampere hours.

The Exide Rectifier enables you to recharge your "B" battery from your house current at a cost that is insignificant.

Ask to see the Exide line at any Exide Service Station or Radio Dealer's.

For better radio reception use storage batteries

Prices Exide Radio Batteries

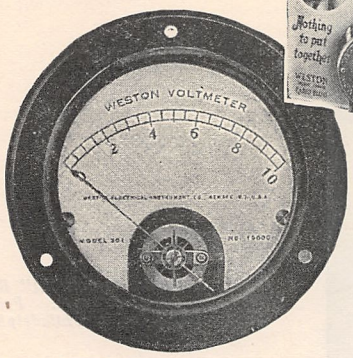
Battery	Capacity	Voltage	Price F.O.B. Philadelphia	Battery	Capacity	Voltage	Price F.O.B. Philadelphia
3-LXL-5	50 A.H.	6	$14.60	1-KZR-5	24 A.H.	2	$ 5.40
3-LXL-7	75 A.H.	6	16.90	2-KZR-3	12 A.H.	4	7.30
3-LXL-9	100 A.H.	6	19.15	12-RB-2	4000 M.A.H.	24	10.00
3-LXL-11	125 A.H.	6	22.10	12-LR-2	6000 M.A.H.	24	12.00
3-LXL-13	150 A.H.	6	25.00	24-LR-2	6000 M.A.H.	48	23.30

Exide Rectifier $2.00

THE ELECTRIC STORAGE BATTERY COMPANY, PHILADELPHIA

In Canada, Exide Batteries of Canada, Limited, 153 Dufferin Street, Toronto

Weston is the original Instant Change Plug—75c Everywhere



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The name Weston on an instrument means distinguishing merit. It protects the buyer. Every instrument and plug is guaranteed. Do not be misled by that phase; "Just as good as Weston." Demand Weston and insist on getting it. If your dealer cannot supply you, write direct to the company.

Prolong Tube Life with this Weston Voltmeter

By operating tubes at correct filament voltage, the life of tubes is increased at least threefold. With this Model 301 Weston Voltmeter you can always duplicate instantly any voltage required. For quick tuning and good reception, it is an absolute necessity. Case diameter 3¼ in. Write for booklet J.

WESTON ELECTRICAL INSTRUMENT CO.
173 Weston Avenue, Newark, N. J.
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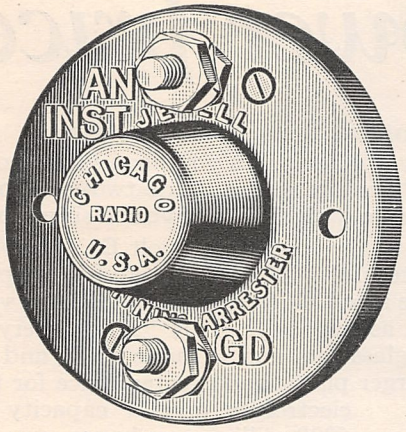
Electrical Indicating Instrument Authorities Since 1888

WESTON

STANDARD - The World Over

JEWELL

The JEWELL *Lightning Arrester*



has been approved by the National Board of Fire Underwriter's (No. E-5403).

Comply with their requirements by installing a Jewell Arrester. (Dark Brown Porcelain Case).

Write for Jewell Radio Instrument Catalog 15-*A*

Price, $1.10 *Order from Dealer*

Jewell Electrical Instrument Co.
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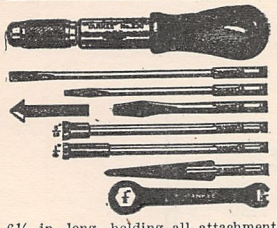
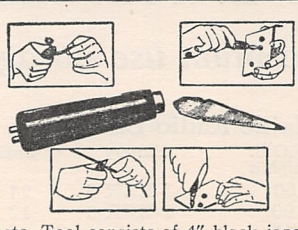
Use "RAGEMCO" Tools to Build Better Radio Sets



ER-701 RADIO TOOL SET

This is the handiest set of tools ever made for Radio Work by the makers of the famous "YANKEE" Tools. It contains the following: 1 Ratchet Screw-driver, 6½ in. long, holding all attachments; 1 Blade, 5½x3/16; 1 Blade, 3½ x ⅛; 1 Blade 2½ x ¼; 1 Countersink; 2 Socket Wrenches for all small nuts; 1 Reamer to enlarge holes in panel from ⅛ x ½; 1 Wrench, one end 5/16" square or hex. for jack, other ½" hex., etc.

ER-701—Price $3.00



ER-702 RADIO HANDI-TOOL

Bends Bus Bar or wire strips and scrapes wire, bores and reams holes, etc. Tool consists of 4" black japanned handle, to which it attached wire bending device, with nickeled ferrule and 3 inches long two sided reamer.

ER-702—Price 50c

Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list.

THE RADIOGEM CORP., - - - - 66-R-W. Broadway, New York City

out messages for a new consular officer and another radio officer for Samoa."

Shortly after daybreak we passed through the narrow opening in the reef into Aleipata harbor. At half speed we slowly bumped our way over the coral beds to an anchorage. Father Dumas put out in his boat to land the party. He had heard VMG transmitting his message to me. The operator had informed him that assistance was on its way. He was interested in the mountain of baggage. "What is all that?" he demanded. "Radio equipment?" He shrugged his shoulders in disappointment when informed that the bulk of it was surgical supplies.

ALL NATIONS

We found the patient better. The news of our departure was the first ray of light in a week. Father Dumas, a Seventh Day Advent missionary, a Mormon from the deserts of Utah, and all the traders of the district, had been in consultation over Father Deihl. A heavy book in French was the only medical authority among them. With Father Dumas translating, they had studied the charts and the symptoms for remedies. One was in favor of calomel, another was for turpentine, yet another was convinced that sodium salicylate was the only remedy. The patient settled the discussion by taking all.

The doctor listened to the history of the case and examined the patient. She found that he had been suffering from appendicitis. The attack was subsiding and the patient could be moved to Apia Hospital for operation in a more favorable situation.

The doctor's assistants were released for radio work. At seven in the evening we succeeded in establishing communication with Apia. The operator politley hoped that we had survived the perils of the sea and gave us the press from New Zealand and Apia.

The mystery of Father Dumas' message was explained. The United States tug *Ontario* was cruising off Aleipata searching for a missing boat-load of natives from American Samoa. Letting his receiving set radiate, and by tapping the antenna lead on the binding post, Father Dumas had sent his message to the *Ontario*. The SOS call was relayed to NPU in Pago Pago. Pago Pago called Apia and the operator at VMG, unable to telephone the message to me, waited until he heard me tune in on 2,000 meters. Simple enough, but a roundabout way of getting a message through.

The European colony composed of the New Zealand Resident Commissioner, our Mormon friend from Utah, the Australian Seventh Day Adventist, a Prussian soldier now trading in Aleipata, a Belgian trader, and a trader from Iceland met to welcome us. They meet on the veranda of the mission house each week to settle international affairs. They call themselves the Aleipata Section of the League of Nations. Out of gratitude for the arrival of the relief expedition, we were elected to honorary membership in the association.

SOME REAL DX

Marvelous reports had reached us at Apia about Father Dumas' reception of distant stations at Aleipata. We exhibited a slight skepticism as to the whole truth of these reports. The Aleipata members came loyally to the defense of their radio station. They told us that Father Dumas gave them the press hours before it was posted on the board at Apia. The Belgian whistled, "Yes, We Have No Bananas," as he heard it rendered by a saxophone soloist at KFI in Los Angeles. The Prussian admitted that he had attempetd to fox trot to music broadcast by California stations. The young Mormon produced his diary and exhibited the score of the World Series as copied from KPO in San Francisco. "Gee," he exclaimed, "it's good to get the play by

Not a makeshift—but a real Loud Speaker *with the famous "Manhattan Concert Modulator"*

It's not a makeshift—it's not just a headset in a horn—but a real loud speaker that reproduces all radio programs with excellent musical quality.

The Manhattan Junior has a reproducing unit especially and correctly designed to operate the long air column of the horn. The diaphragm is large and heavy — firmly locked in place—no rubber is used. The permanent magnet is extra large—and no batteries are required for operation.

The Manhattan Junior is the only loud speaker in its price class to have that most necessary adjustment—the "Concert Modulator." The importance of this feature, first introduced and popularized on the Manhattan Loud Speaker, is now thoroughly established. By means of it, the instrument can be satisfactorily accommodated to set, tubes and the strength of "B" battery current, so that the best results can always be obtained. It also eliminates any possibility of "chattering" caused by overloading from powerful receiving sets.

Hear the Manhattan Junior demonstrated at your nearest dealer—its musical qualities will astonish you.

Made by the makers of the famous Red Seal Dry Batteries

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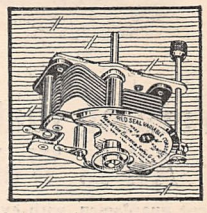
New York, Chicago, St. Louis, San Francisco

You'll also want these other Manhattan Products



Red Seal
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A low loss condenser with vernier giving smooth easy tuning control. Ideal for super-critical work. Brass Plates, "pig-tail" connections — shielded against hand capacity.
Price 17 Plate $5.75
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Designed for "DX" work. Tone quality excellent. Workmanship the best. No distortion or chattering. Bakelite case, soft rubber sanitary headband.
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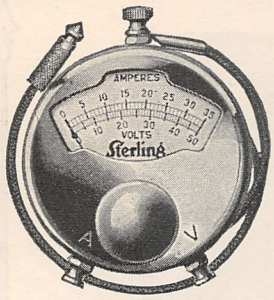
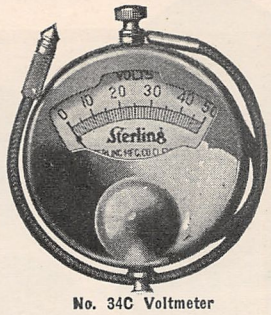


No. 45 Voltammeter



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Silent guardsmen, with eyes that see invisible electrical conditions meaning life or death to your batteries and tubes—that is the part assigned to Sterling Meters in the radio world. These meters are as dependable as an ocean liner's compass. They tell the truth and steer you free from radio difficulties.

Sterling Pocket Meters are known from imitations by the bulge on their metal face. It pays to be sure of getting genuine Sterling meters.

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No. 34C Pocket Voltmeter for testing radio "B" batteries up to 50 volts. 0-50 volts, 1 volt divisions. **Price** **$2.50**

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Sterling Panel (Filament) Meters are a source of protection to your tubes against burn-outs and for measuring the voltage across the filament to obtain correct rheostat setting. Meters mounted on the panel are most convenient.

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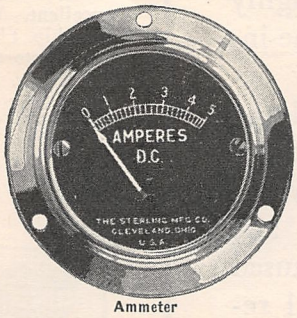
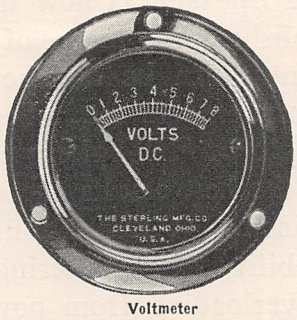


Ammeter



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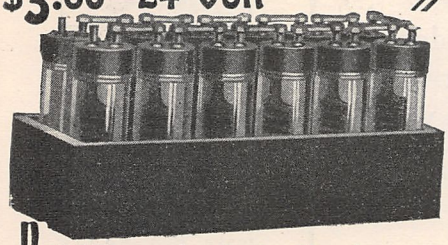
$3.60—24 Volt



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"A" Battery. 6 volt—full 100 amp. hr. capacity. Made for radio work; has handy carrying handle; 2-4 and 6 volt taps. Finished oak case. All "A" Batteries shipped fully charged. PRICE **$13.90**

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"B" Battery Hydrometer. Standard instrument, carefully graduated. Special price...75c

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Send 25% of price with order, balance C.O.D. All storage battery prices F.O.B. Cleveland. This is your opportunity to make a big saving on all radio materials. Send your order today.

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play account of the games. Almost like being there."

These isolated whites in Aleipata spoke familiarly of the new Los Angeles Biltmore Hotel dance music, the Los Angeles Ambassador Hotel Cocoanut Grove Orchestra, and Hale Brothers' Studio in San Francisco. They regretted there was no Spanish representative to translate the press broadcast in Spanish by the Los Angeles *Times*. The evidence was overwhelming. We apologized. Father Dumas is firmly established as a radio expert in Samoa.

The return trip to Apia was uneventful. The patient stood the voyage well; certainly he arrived in a happier frame of mind. The American telephone transmitter had established communication between Apia and Aleipata. The amateurs had met the emergency. Amateur radio had again acquitted itself with credit.

Clearing the Ether of Electric Power Noises

(*Continued from page* 657)

of the committee include its services as a clearing-house for information regarding conditions and methods employed in different localities, all member companies co-operating. Experimental work to determine the best methods and equipment for locating various sources of trouble and for suppressing or eliminating radiation from electrical equipment and appliances, is planned. The education of the radio public as to the above problems is also suggested, in order that the fan may receive the benefits from the experimental work in his interest.

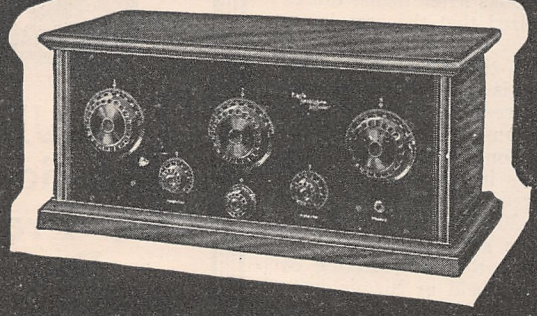
In a recent article, the editor of a radio magazine gives special prominence to a statement to the effect that: first, if there is a lot of noise which interferes with reception, the owner of the receiving set is justified in suspecting that the power circuits and equipment in his vicinity are causing the trouble; and, second, it is a relatively simple matter to locate such sources of disturbance.

While believing neither of these assertions true, the problem was nevertheless presented to the power companies in such a manner that they could ignore it, and a radio subcommittee including W. R. G. Baker, General Electric Company; C. A. Boddie, Westinghouse Electric & Mfg. Co.; J. G. Hemstreet, Consumers' Power Co., Jackson, Mich.; E. P. Peck, Utica Gas & Electric Co., Utica, N. Y.; G. A. Vahey, Edison Elec. Illum. Co., of Boston; A. F. Van Dyck, Radio Corporation of America, H. L. Wills, Georgia Ry. & Lt. Co., Atlanta, Ga., and A. M. Wilson, University of Cincinnati, was appointed.

The sub-committee soon discovered that, while radio interference was being widely discussed, no organized effort had been made to secure definite data regarding the extent to which power circuits and apparatus have been a cause of radio interference and that no other organization existed for the definite purpose of investigating these problems and furnishing information concerning them to the power companies and others interested.

The Radio Corporation, the General Electric Company, and the Westinghouse Company had been obliged to consider radio interference, because of specific complaints presented to them. A few of the larger operating companies had, as a matter of public policy, taken cognizance of complaints of radio interference, and done some very valuable pioneer work in locating sources of such trouble. By tying all these constructive factors together, the committee hopes that results of value to the radio and power interests, as well as to the "fans," will be secured.

The GREATER Neutrodyne



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Every instrument that must carry any responsibility for the efficiency of the EAGLE Model B Receiver is made in the EAGLE factory under the supervision of EAGLE engineers.

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The vastly improved instruments described in the adjoining panel CANNOT BE PURCHASED ANYWHERE AT ANY PRICE except as incorporated in the NEW Model B EAGLE Receiver. Developed explicitly for the EAGLE Model B.

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You want the very latest improvements in your radio set. Then you want these ADVANTAGES—multiple switch, ball-bearing, die-cast condensers, and the recently developed revolving resistor element rheostat.

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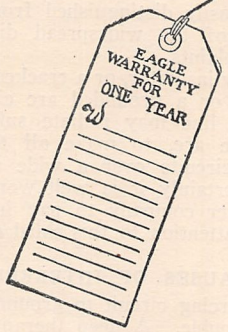

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The EAGLE is Warranted for ONE YEAR.

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An entirely new departure in condensers. Both rotor bearings are ball-bearing. Rotor and stator plates are die cast integral with their support.

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The resistor element, instead of the contact, is the operating unit in the EAGLE rheostat.

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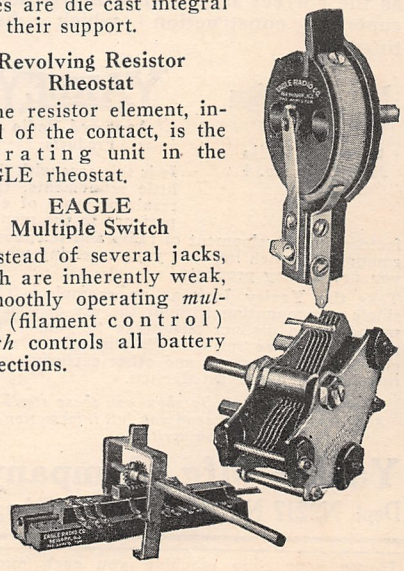
Instead of several jacks, which are inherently weak, a smoothly operating *multiple* (filament control) *switch* controls all battery connections.



Licensed by Independent Radio Manufacturers, Inc., under Hazeltine Patent Nos. 1,450,080, *dated March* 27, 1923, *and* 1,489,228, *dated April* 1, 1924. *Other patents pending.*

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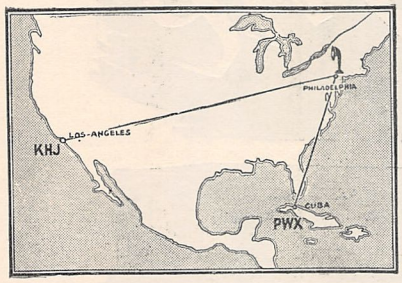

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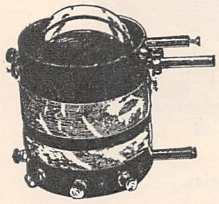

The Only Licensed all Litz Tuner

$5.50

At all good dealers

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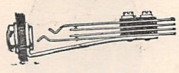
That Improve Receiving

You will like the extreme care given to every detail in the manufacture as well as the correct and original design and superior construction which distinguish



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Take the Yaxley Jack as an example. The single nut mounting without the use of spacer washers is a distinct advantage to you. The phosphor bronze springs, the pure silver, self-cleaning contact rivets and other exclusive features, mean better satisfaction.

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Some power companies apparently take the position that it is a serious mistake to give any consideration to complaints of radio interference; others apparently consider radio interference complaints as one of the many opportunities of establishing cordial relations with their customers. Some companies seem to hesitate to admit that defects in their circuits can be indicated by radio interference complaints; others consider these complaints as valuable sources of information. Some companies turn all information regarding radio complaints over to one individual, who looks after them; others seem to be so organized that the complaints are lost.

But the interest of the power companies in radio interference is growing, partly because of increasing pressure from the radio "fans" and partly because of increasing kilowatt-hour consumption from the same source. In companies in which such statistics are available, records show that radio is responsible for a 20 per cent. increase in lighting kilowatt-hour sales.

Early in the spring, the first meeting of the sub-committee was held in Birmingham, Ala. There was not much definite information available, so a very simple blank form was sent to a number of widely separated companies in order that some specific information might be obtained, which would indicate the nature of the complaints, what the companies did about them, and the results secured. At the second meeting, held in Philadelphia, Pa., these data were available, and there was a good attendance.

From the discussion it appeared that there is general agreement that complaints of radio interference may be divided into three classes. The first class is composed of complaints from those who do not know enough about radio or power problems to complain intelligently. Generally these troubles are due to wrong installation or poor adjustment of receiving sets. The second class are complaints due to interference from some more or less local source for which the power company cannot be held responsible. Generally, both the first and second classes can be quickly distinguished, because the complaints are individual or in rather small groups. The third class is composed of actual cases of interference caused by trouble in the power circuits. Generally this class can be easily distinguished from the others because of the widespread distribution of the complaints.

A leaky insulator, or a cracked transformer bushing, or a grounded arc circuit or distribution line may radiate sufficient power from the arc, to make all the radio receiving circuits over a wide area inoperative. Certainly it is well worth while for any power company to pay immediate and careful attention to this third class of complaints.

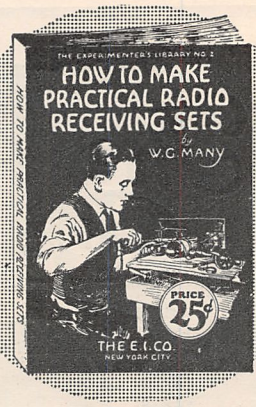
CAUSES OF INTERFERENCE

Any arcing circuit to ground will usually cause trouble. A deep therapy or a violet ray machine, or the high voltage rectifier of electric precipitation equipment may produce the same effect. So, in many cases, it is necessary for the power company engineer to diagnose the case carefully in order to save time.

Sometimes arcing at the commutators of d.c. machines will cause radio interference. Even in the case of railway motors, where the arc itself is thoroughly shielded, it is claimed that radiation from the motor leads and trolley wires may cause serious interference; but, so far as the sub-committee is aware, there are no positive data regarding specific cases to establish values for this type of interference. However, cases of radio interference from trolley circuits have been encountered.

REMEDIES DEVELOPED

One of the most active members of the sub-committee, in tracing causes of interfer-



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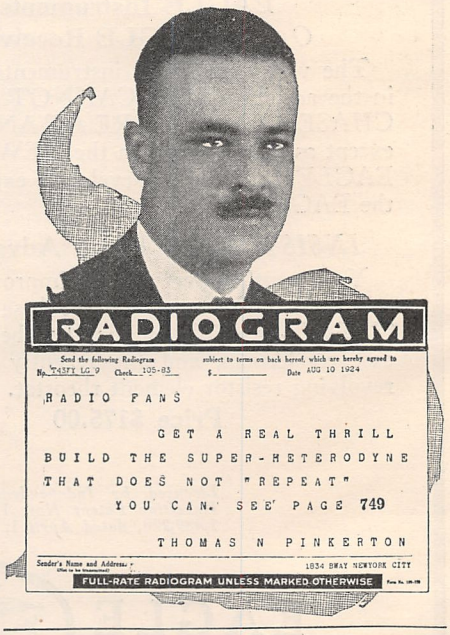

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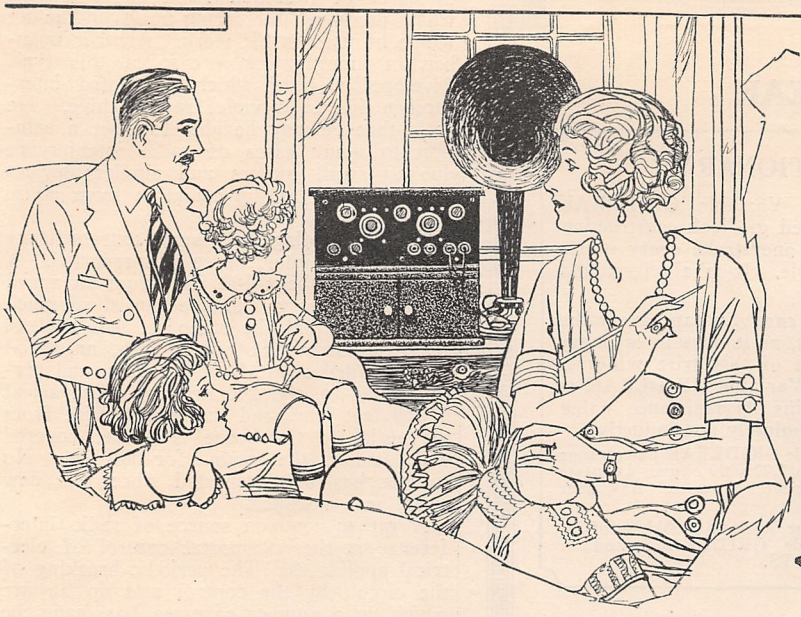
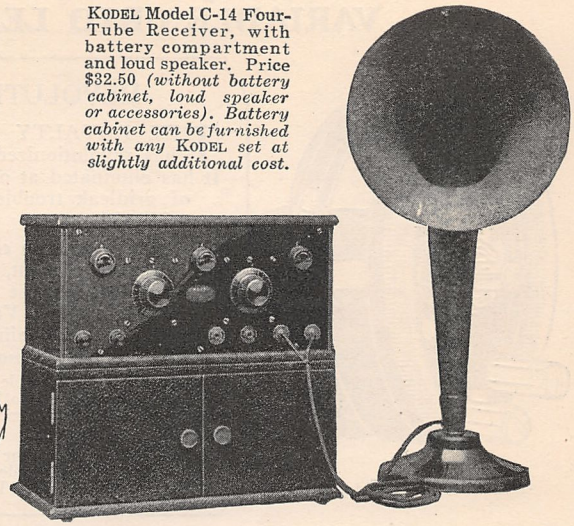


KODEL Model C-14 Four-Tube Receiver, with battery compartment and loud speaker. Price $32.50 *(without battery cabinet, loud speaker or accessories). Battery cabinet can be furnished with any* KODEL *set at slightly additional cost.*



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KODEL is the name of a circuit discovered by an independent experimenter. So wonderful is the KODEL circuit that it picks up stations 1000 miles away, using only one tube and *no antenna,* when conditions are right. Add tubes and you increase distance and volume until you succeed in covering 3000 miles on the loud speaker. All this with only a single dial to turn!

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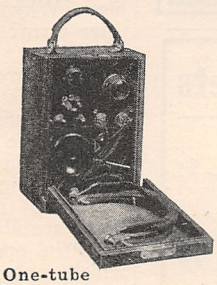
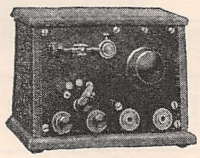
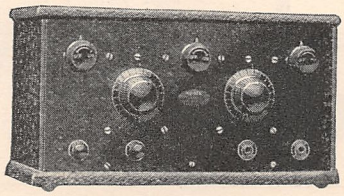


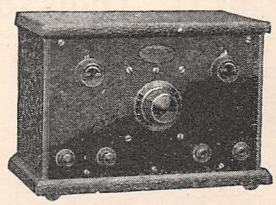
Model P-11 One-tube Portable—the Camera of Radio—price $16.00 without accessories. *Tube, batteries, head-phones, antenna and ground wire all self-contained. Weight 4¾ lbs. complete.*



Model S-1, KODEL Crystal Set. *Sensitive, selective, low priced*—Price $5.00.



Model C-13 Three-tube Receiver—$28.00. *Gives five-tube volume with only three tubes, due to reflex amplification.*

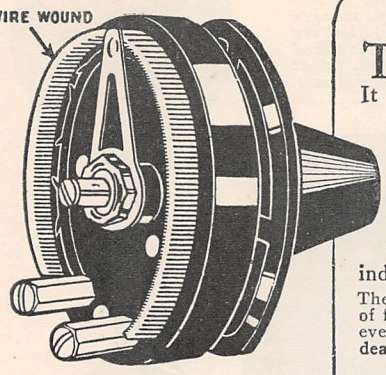


Model C-12 Two-tube Receiver, $18.00—*A great distance getter; puts local stations on the horn; single dial tuning.*

Model C-11 One-tube Receiver—*The biggest value in a one-tube radio set to-day.* Price $10.00

RADIO FOR EVERY PURPOSE AND ANY PURSE—$5 TO $32.50

ROYALTY
VARIABLE GRID LEAK



REVOLUTIONARY !

THE ROYALTY Variable GRIDLEAK has revolutionized gridleak construction. It has eliminated at one stroke every source of gridleak trouble. It is a *wirewound* gridleak!

The lever arm *cannot* scrape away the resistance element, as it does in ordinary gridleaks, because of this wire winding. The ROYALTY Variable GRIDLEAK is noiseless; it retains its resistance value indefinitely. It is absolutely non-inductive.

The ROYALTY Variable GRIDLEAK has a range of from 100,000 ohms to 7,000,000 ohms. It meets every gridleak requirement and more. **Ask your dealer!**

FREE—Write for hook-up booklets of ROYALTY Variable GRIDLEAKS and RESISTANCE UNITS.

WIRELESS PRODUCTS CORPORATION
136 Prince Street, New York City

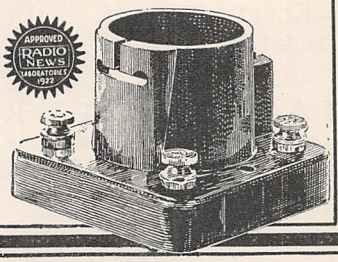
BELL Dials

make their best appeal on sets that combine good performance and good looks. They are molded from Bakelite—highly polished, with clean-cut engraving and readable white figures. Bushings are brass; set-screws out of sight. Bell Dials are strong; unaffected by temperature or moisture, and will not change color. Packed in individual blue boxes with the Bell trade-mark. In 2, 3, 3½ and 4 inch sizes.

BELL Square Sockets

lead in efficiency. Solid molded Bakelite, for standard base tubes. Unique double-wipe spring contact makes perfect connection, even with uneven tube prongs. Contact will not vary with constant use. Leakage and current losses cut to a minimum. In the blue Bell box.

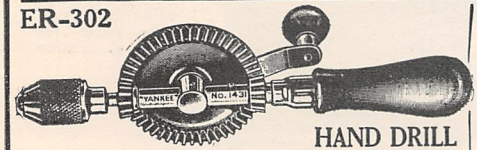
DEALERS: Write us for circular on molded Bakelite sockets and dials if your jobber does not stock BELL Radio Products.



BELL MANUFACTURING CO.
11 ELKINS STREET BOSTON 27, MASS.

Use "RAGEMCO" Tools to Build Better Radio Sets

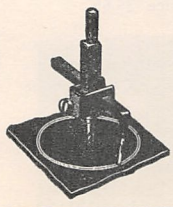
ER-302



HAND DRILL

Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill, with 4 to 1 ratio of gears for speed. Special chuck 9/32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 9½ in. Weight 1½ lbs.
ER-302—Price $2.75

ER-402 CIRCLE CUTTER



Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts bead or scroll around the hole in one operation. Cuts holes ¾ to 4 in. in diameter.
ER-402—Price $3.00
ER 401. Same tool but smaller and not fitted with bead or scroll in one operation.
ER-401—Price $2.00

Order by order numbers. Remit by check, money order, stamps or cash. All goods are shipped free of transportation charges to all parts of U. S. and possessions same day as order is received. If not satisfied, money will be refunded upon return of goods.

We carry a complete list of Radio Tools. No matter what you want we have it in stock. Write for our complete tool list.

THE RADIOGEM CORP., - - 66-R—W. Broadway, New York City

ence, reported that he had found a number of cases of radiation from house wiring, which produced interfering noises in the set which he used in his work. Another member, in investigating a case of this type, developed a filter which eliminated interference due to a violet ray machine. He feels that he may be able to offer a solution to many cases of radio interference due to small motors and similar devices which tend to set up radiation from house wiring.

One interesting and very extraordinary case of radio interference was reported. A 140 kv. line about 100 feet from an aerial at right angles to the line caused so much interference that the radio set was useless. After a number of experiments, an aerial was installed about 400 feet from, and perpendicular to, the 140 kv. line. The aerial is 250 feet long, and the lead-in wire from the aerial to the house is rubber covered wire, laid on the ground for 300 feet. No trouble has been reported since this new aerial was installed.

A rather common source of radio interference is the thermostat control of electrical appliances. The periodic breaking of the circuit by the control sets up an arc which, in a number of cases, has made the receiving set in the home inoperative.

RECOMMENDED EQUIPMENT

There was considerable discussion of the type of set to be used in tracing sources of interference, it being generally agreed that a very sensitive loop set should be used. One of the sets described utilized a non-directional loop aerial mounted horizontally in the top of a car. While it would perhaps be more advantageous to use a small vertical loop so as to take advantage of its directional effects, the non-directional loop also seems to be desirable under certain conditions. The types of sets which appear to have given the best service for noise detection and location are the Reflex and Super-Heterodyne types, so arranged and mounted as to be fairly portable and convenient for use in an automobile.

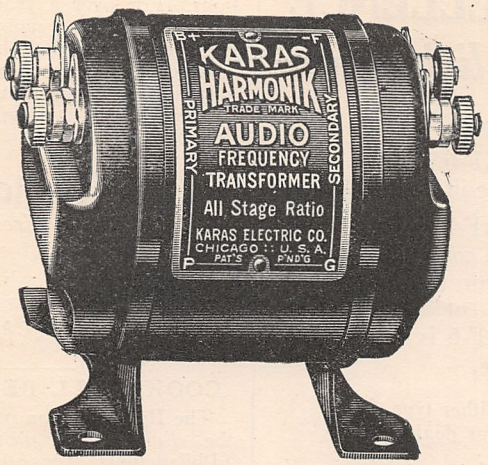
In a recent case of radio interference it was found impossible to get compass action from the loop of the exploring set until the rest of the set was shielded by means of sheet iron. The radiation from the source of trouble apparently affected the tuning circuits within the exploring set.

Ask Hoover He'll Do It

(*Continued from page* 709)

foolish, however, and with the marvelous expansion of radio and its new applications the officials have to consider all requests carefully. Should licenses be granted for the transmission of radio pictures still and moving? Why not? And yet, who would receive them? This type of message or communication will require a wave channel which many other services may want or need. This is one of the serious questions which requires immediate thought. Radio pictures are practical and while not yet on the air, they will undoubtedly create interference in the channels now in use.

Besides the 533 land broadcast stations, there are about six portable broadcast stations in operation, chiefly in automobiles which move about the country from zone to zone and from one radio district to another; many more are desired. What wave-lengths and hours can be assigned these operators? Of late, ships are asking for broadcast licenses, and the Department is hesitating to open this new field on account of the trouble a mobile broadcaster might cause in the well established and busy radio channels in operation. The S.S. *Leviathan* tried out broadcasting experimentally and now desires a regular license,



KARAS HARMONIK $7.00

Far, Far Better Reception Than You Have Ever Known

Or

Your Money Back Immediately

MAIL THE COUPON AT ONCE for a pair of the Marvelous, New, Karas Harmonik Audio Frequency Transformers. Put them in that new radio set you are building or put them in your old set in place of the transformers you are now using. Try them out—test them thoroughly for 60 days.

If YOU don't enthusiastically agree that they give you the most delightful radio reception you have ever heard send them back and we will return your money immediately without question or quibble.

That's our special introductory offer.

Those who are now using Karas Harmonik Transformers in their radio sets are so pleased with the surprisingly better reception they are enjoying that they tell us if we could REALLY describe to all radio enthusiasts the exquisite pleasure of hearing this wonderful reception they would all want Karas Harmoniks in their sets, at once.

But we don't know how to adequately describe the delightfully rich, round, full, clear-as-a-bell tones of Karas Harmoniks. The only way to fully realize what a vast improvement they make in ANY radio set is to actually hear their surprising reception. That is why we make you this unprecedented trial offer.

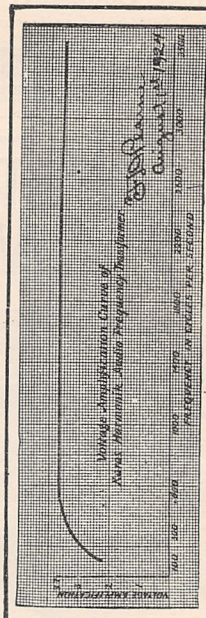
We are stocking the dealers with Karas Harmoniks just as fast as we can. In the meanwhile we are making this "Proof By Trial" offer direct to those radio enthusiasts who are keen to enjoy radio reception at its very best. If your dealer already has secured his allotment of Karas Harmoniks he is authorized to make you this offer.

We might give pages to telling you WHY Karas Harmonik Transformers give purer, sweeter, more natural music than any transformer ever built before. But you had much rather hear and enjoy their actual performance than to just read about how and why they are so wonderful.

That's why we simply say "Try a pair of Karas Harmoniks at our expense and hear with your own ears the beautiful musical tones they deliver. Judge from their performance whether they give Far Better Reception Than You Have Ever Known."

Mail the coupon today. Please write your name and address very plainly.

KARAS ELECTRIC CO., 4040 N. ROCKWELL ST. DEPT. 59-48 CHICAGO



The secret of the strikingly wonderful reception of Karas Harmonik Audio Frequency Transformers is disclosed by this Scientific Laboratory "Curve" of their actual performance.

Low frequencies represent low notes. High frequencies represent high notes and the harmonics of low notes. The bulk of musical sound is made up of many high frequency harmonics and overtones. It is the combination of these harmonics forming a single note that makes it a beautiful, pleasing, musical sound. The absence of fully amplified harmonics causes distortion and unnatural sounding tones.

The "Curve" shows that Karas Harmonik Transformers amplify all tones equally delivering pure, natural musical reception that is a delightful pleasure to listen to.

To Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobber and dealer channels is being carried out as rapidly as the output of our factory permits. In the meantime mail applications will be taken care of in the order they are received, on an allotment basis. Write us for test records, discounts, etc.

To Set Manufacturers

We positively prove that Karas Harmonik Audio Frequency Transformers will vastly improve the musical quality of your set by any form of test you wish to impose. When you are convinced of this you will naturally want to use them. Write or wire us and arrangements for tests will be made promptly.

Send No Money With this Coupon

Karas Electric Co., Dept. 59-48
4040 N. Rockwell Street, Chicago, Ill.

Please send me.....pair of Karas Harmonik All Stage Ratio Audio Frequency Transformers. I will pay the postman $7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 60 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name.....

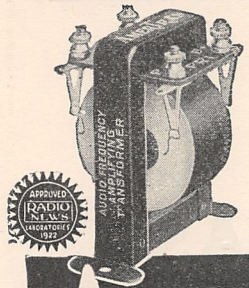
Address.....

City.....

Dealer s Name.....

Dealer's Address.....

If you send cash with order we'll send transformers postpaid.



STANDARD of EXCELLENCE
for Audio Amplification

Made in Two Types:

AmerTran AF-6 (Turn ratio 5) for use in the first stage.

AmerTran AF-7 (Turn ratio 3½) the companion transformer for use in further stages of amplification where AF-6 is used in the first stage.

Price, either type, $7 at your dealer's.

AMERTRAN
TRADE MARK REG. U.S. PAT. OFF.

Improve Your Set With An AmerTran

Send for booklet containing much helpful transformer information.

American Transformer Company, 177 Emmet St., Newark, N. J.
Designers and builders of radio transformers for over 23 years.

National VELVET VERNIER Condensers and Dials

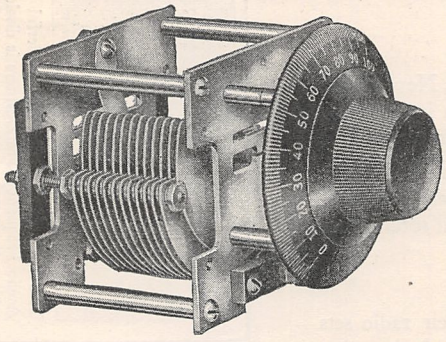
Grounded Rotor Shielded Stator

Heavy Aluminum Plate

Radion Hard Rubber

Low Loss

Used by Browning and Drake before the American Inst. of Electrical Engineers



PRICES

DX Condenser including 3" Vernier Dial.

.001 .....$7.00
.0005 ..... 6.00
.00035 ..... 5.75
.00025 ..... 5.50

Velvet Vernier Dial Only

4" $2.50
3" 2.00

PERFECT RESONANCE CONTROL

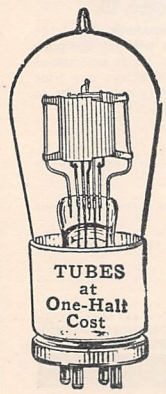
That is the way that a user of a NATIONAL VELVET VERNIER DIAL and CONDENSER describes the liquid smoothness and flexibility of this Perfect *Slow Motion* Dial and *Low Loss* Condenser.

Perfect because of perfect design and skilled craftsmanship. No gears—no grating—no backlash. Every part in perfect accord.

A Perfect Control For the Whole Dyne Family

Made by

WRITE FOR BULLETIN 104 R.N. **NATIONAL COMPANY, Inc., Cambridge, Mass.**



Save ½ Cost of New Tube

Guaranteed Vacuum Tube Repairs at Popular Prices

We try to maintain 24-hour service.
All repairs guaranteed.
Tubes satisfactory or money refunded.
Special discounts to dealers.
Send broken and burned out tubes parcel post.
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S. HAMMER RADIO CO.
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$8.50 N & K Phones 4000 ohms Model D	$5.90
12.00 Dr. Seibt Phones, 6000 ohms	5.75
7.00 Superdyne Coils, Genuine	4.95
7.00 Ambassador Coils, Genuine	4.95
12.00 Baldwin Phones (Type C, Double)	7.95
7.00 Federal No. 65 or AmerTran Transformers	5.25
12.50 Como Duplex P.P. Transformer	9.75
30.00 Music Master Loud Speaker	24.00

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Not Insured Unless Insurance Charges Included.
Orders over $5.00 shipped Prepaid.

5000 RADIO DEALERS buy from **HUDSON-ROSS**
123 W. Madison St. Chicago
Send for dealers discount.

but the Shipping Board has not been authorized to operate such a station yet. Some time ago a steamer on Lake Pontchertrain, near New Orleans, tried out a similar plan but could not compete with local land stations. For over a year the Al. G. Barnes Circus operated a mobile broadcast station, but eventually found that a portable broadcast set was too expensive. Another portable license was sought by a theatrical performer playing one-night stands throughout the country.

Radiotics

(*Continued from page* 704)

over, in fact, its a whale of a shield! No directions are given as to the point in the shielding the receiver should be placed.

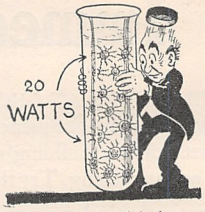
Contributed by Burton Proctor, Jr.

COOK WELL BEFORE SERVING

The Radio Section of the *Public Ledger* (Philadelphia) for August 23, 1924, contained the following gem of an advertisement: MACARONI Switch Points. Complete with 6-32 hexagon brass nuts, 5 cents per dozen. This is a dish which should be on the menu of every restaurant. The chef who discovered it must have been a radio bug. The hexagon brass nuts should be served with a sauce of Azotic Acid to aid in digesting the brass.

Contributed by William H. Rigby.

EXCESS WAR MATERIAL?



The August 24, 1924, edition of the Boston *Sunday Post* contained the following advertisement: "We have in stock 150 genuine GERM transmitting tubes. Rated at 20 watts." The attention of the Boston Board of Health should be called to this dealer before these dangerous tubes get into the hands of radicals who might attempt to create a plague and wipe out the nation.

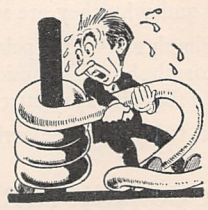
Contributed by Joseph Kazokas.

SPREAD IT ON YOUR AERIAL WIRES

The American Radio Stores, Inc., in the August 22, 1924, edition of the Philadelphia *Evening Bulletin* advertise "HONEYCOMB OIL MOUNTINGS." By experience we have found that such oil requires no mounting; it will mount itself. It is fine stuff to smear on the aerial wires to help the concerts slide down the lead-in into the receiving set.

Contributed by W. Ridgway Petre.

USE A RAIL BENDER TO WIND THIS COIL



The Albany *Enterprise* (Minnesota) of August 21, 1924, contains a description of an untuned primary coil of rather unique construction. It reads as follows: "From ten to twenty turns of wire ABOUT THREE TO FOUR INCHES IN DIAMETER, to be determined by experiment, may be placed on the same tube as the secondary." Enuf said! *Contributed by Karl P. Dirondorf.*

GOLDEN-LEUTZ

SUPER PLIODYNE-6

TRADE MARK REG.

"The Perfect Broadcast Receiver"

A NEW SUPERIOR BROADCAST RECEIVER

SIMPLE-LONG RANGE-HIGHEST QUALITY
NON RADIATING - NON REGENERATIVE

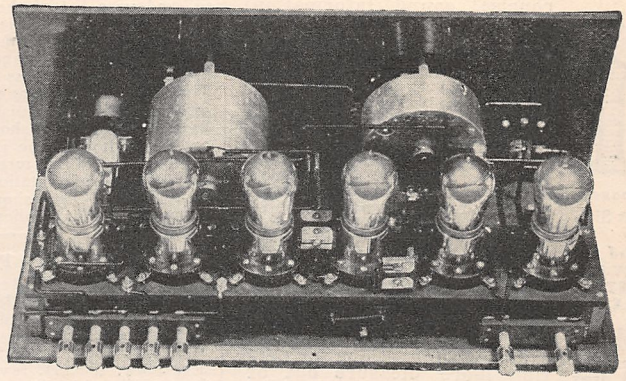
Two Stages Tuned Radio Frequency-Detector and Three Stages of Audio Frequency Amplification

$95.00

Completely Constructed

Transportation Prepaid

PLIODYNE 6
Front View Showing Simplicity of Control



PLIODYNE 6
Interior View Showing Compact and Efficient Design.

A New Marketing Plan

Rather than sell this high grade receiver to wholesalers at $190.00 less 50% discount we are going to sell it direct to you at wholesale, saving you $95.00 and at the same time giving you the finest set that can be bought for twice the amount.

Inspect the "PLIODYNE 6" At Our Expense

We will send the "Pliodyne 6" C. O. D. transportation prepaid with privilege of inspection. If it does not appeal to you as the finest medium priced broadcast receiver you ever saw, return it to us at our expense. *Otherwise take advantage of*

A FREE TRIAL

Accept the C. O. D. and try the "Pliodyne 6" for five days. If you are not satisfied in every way return it at our expense and we will return your money.

Our Guarantee

We guarantee every Golden-Leutz "Pliodyne 6" to be the finest broadcast receiver that can be manufactured using 6 tubes or less and to be satisfactory to you in every way and to reach you in perfect condition.

You take no risk whatever in sending us your order for unless you are completely satisfied with the receiver and with your saving you may return the receiver to us and we will refund your money.

GOLDEN-LEUTZ, Inc.

476 Broadway, - - New York City

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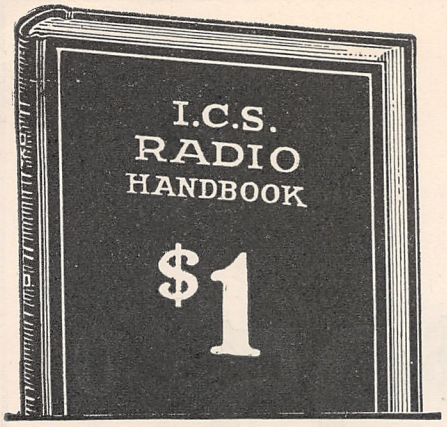
NOTE:—We reserve the right to withdraw the Free Trial Offer if our Factory Production is exceeded. Golden-Leutz, Inc.



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Price Only

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514 pages

Pocket Size

Compiled by HARRY F. DART E.E.

Formerly with the Western Electric Co., and U. S. Army Instructor of Radio.

Technically edited by F. H. DOANE

LIKE a little radio encyclopædia, this I. C. S. Radio Handbook is packed with concise, sound information useful to everybody from beginner to veteran hard-boiled owl. It starts with simple explanations of radio phenomena and leads you along gently until you can understand the most technical diagram.

You may dip into it at random, or hunt up special information you want, or read it right through. Different types of receiving and sending hook-ups are explained; electrical terms and circuits; antennas; batteries; generators and motors; electron (vacuum) tubes; interesting experiments; definitions, and thousands of suggestions for getting more pleasure out of radio.

A pocket course in radio!

Every page tells you something useful, and there are 514 pages; hundreds of illustrations and diagrams. It is the biggest dollar's worth in radio, and will save you from wasting money on things that don't work.

Send $1 to-day and get this 514-page I. C. S. Radio Handbook before you spend another cent on parts. Money back if not satisfied.

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Box 8284-C, Scranton, Penna.

I enclose One Dollar. Please send me—postpaid—the 514-page I. C. S. Radio Handbook. It is understood that if I am not entirely satisfied I may return this book within five days and you will refund my money.

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FULL SIZE ANTENNA-150 FT. STRANDED COPPER WIRE

NOT AFFECTED BY WIND, RAIN, SNOW OR LIGHTNING

CERTIFICATE OF APPROVAL by one of Largest Radio LABORATORIES sent

PRICE $7 POSTPAID or $5.00 and 4 ADDRESSES SET OWNERS

Ask about our NOISE KILLER

INTER-STATE SIGNAL CO., Dept. 3 COLUMBUS, OHIO

New QRA'S

(*Continued from page 680*)

NOTICE—The new address of station 5WC owned and operated by J. B. Gaines is 724 South Winnetka, Dallas, Texas.

HAMS TAKE NOTE

Editor, RADIO NEWS:

Will you publish a note in RADIO NEWS to the effect that I will listen for U. S. A. Brass Pounders during the winter and will QSL any calls heard?

If the Hams will let me have a card giving me the time they are on the air, also QRH, I will be right on the job.

H. CONSTABLE,
6 Leysfield Road, Shepherds Bush
London W12, England

Calls Heard

This space is set aside each month for the listing of amateur calls heard. We invite you to send us a list of the stations you have heard, typewritten if possible, or at least sufficiently readable to prevent mistakes. Print the calls on a separate sheet of paper, using but one side and listing the calls across the page, not in columns. These should be arranged alphabetically for each district. To distinguish the stations that have been worked, they should be put in parenthses, and, according to the rules now in use, the C.W. stations should be mentioned in a separate list. Do not include stations less than 1000 miles distant. The lists should reach us by the first of the month for publication in the following issue.

90A, 408-9th ST., PETERSBURGH, IND.

1aeg, 1bex, 1xak, 1cmx, 1ama, 1asr, 2wg, 2kf, 2le, 2cqz, 2wz, 2za, 2rk, 3bnu, 3dx, 3cjn, 3cdk, 3buy, (3hs), 3cbm, 3cdn, (3auv), 3qt, 3oe, (4fg), 4ai, 4ey, 4ft, 4dv, 4pv, 4dx, 4hz, 4it, 4kl, 4bq, 4tj, 5fm, 5gp, (5aiy), 5fs, 5ka, 5amf fone, 5amw, 5jf, 5es, 5akw, (5aam), 5vv, 5alz, 5wi, 5ajs, 5ph, 5rg, 5apc, 5ajh, 5uk, 5amh, 5wo, 5apt, (5nw), 5amb, 5ua, 5cn, 5ns, 5wk, 5sg, 5iq, 5sd, 8cpk, 8die, 8buc, 8bhe, (8cwr), 8dae, 8bll, 8qb, 8app, 8apr, 8bmb, (8aer), 8dmk, (8er), (8ak), 8bnh, 8zg, 8rj, 8cmu, 8tj, 8dhs, 8bmt fone, 8atp, 8brc fone, 8dec, 8aig, 8cyl, (8yx), 8bur, 8cva, 8dc, 8ki, 8cmb, (8ajn), 8chp, (8dnf) qra-, 8ago, 8bpl, (8dhw), 8dfw, 8dmm, 8bkh, 8aq, 8amb, 8ct, 8dgo, 8cd, 8dt, 8avl, 8sf, 8dfm, 8wx, 8cwp, (8cxm), 8daw, (8bqr), 8brg, (8aii), (8wz), 8atp, 8abm, 8cnw, 8dsn, 8dki, (8bkm), 8uf, 8bwb, 8con, 9aud, 9hj, (9alb), 9dfq, (9djn), 9aps, (9ayx), 9eld, 9tv, 9uz, 9aaw, 9ccw, 9bkk, 9la, 9afy, (9vw), (9bwf), 9amb, 9cyq, 9arp, (9es), 9aau, 9mi, (9dgk), 9dqu, (9hp), (9baw), 9cur, 9bpt, 9vc, 9dbm, 9be, 9qz, 9cii, (9ell), 9djg, 9cal, 9chx, (9drc), 9dlp, (9pq), (9baz), 9awg, 9awr, 9mc, 9blg, 9aal, (9chv), 9dlw, 9clz, 9dwz, 9cee, 9dyy, 9abt, 9ni, (9asa), 9csg, 9bmd, 9fb, 9czb, 9dkk, 9hw, 9dwk, 9ead, 9afc, 9dlm, 9cvs, 9dbm, 9db, 9dd, 9eht, 9lb, 9cfs, 9dxh, 9cwq, 9cmn, 9dwx, 9elb, 9cog, 9dsa, 9vd, 9uc, (9ta), (9efz), 9elp, (9kd), 9duc, (9cwp), 9ca, (9bmp), 9cfk, 9dng, 9bmk, 9bkj, 9bce, 9ws, 9bjl, 9ur, 9dpx, 9cze, 9apv, 9eji, (9em), (9dlh), 9com.

Canada: 3vh, 3oh.

Wl qsl a crd if requested. Those hring 90a pse qsl es qrk!

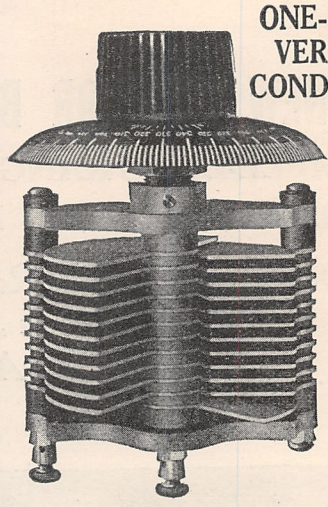
5SJ, PAWNEE, OKLAHOMA

5ck, 5in, 5gw, 5js, 5gm, 5ga, 5jj, 5lr, 5jr, 5ql, 5ed, 5ha, 5sr, 5apy, 5apq, 5qg, 5ajj, 5es, 5gj, 5aqw, 5cq, 5kw, 5lo, 5lr, 5xt, 5zy, 5rj, 5am, 5ak, 5ana, 5bw, 5wi, 5ml, 5lj, 5xac, 5amw, 5aki, 5afu, 5axj, 5eq, 5bgx, 5ph, 5sp, 5to, 5ql, 5cm, 5qw, 5sd, 5uk, 5aes, 5gj, 5pp, 5aj, 5agt, 51q, 5ns, 5amh, 5xaj, 5ga, 5ha, 5hm, 5zav, 5ds, 5va, 5aaz, 5amg, 1py, 1adn, 1af, 1aj, 1kx, 1cib, 1mo, 1xw, 2by, 2rx, 2sm, 2gk, 2rb, 2bg, 2crg, 2bm, 2aey, 3ii, 3jj, 3tb, 3nl, 3he, 4jr, 4hs, 4el, 4by, 4eb, 3ah, 4lj, 4fg, 4bo, 4co, 6do, 6kj, 6zau, 6ck, 6at, 7ln, 7co, 7ls, 7zl, 7aix, 7ej, 8cz, 8ddv, 8com, 8aru, 8hj, 8cqj, 8og, 8cdy, 8mr, 8aj, 8ag, 8sf, 8pl, 8cgj, 8bdn, 8dhk, 9bsi, 9wa, 9ahh, 9bw, 9drw, 9aim, 9bgm, 9ba, 9caa, 9br, 9dt, 9xaw, 9cny, 9cv, 9arj, 9cka, 9aps, 9czi, 9bsc, 9dtn, 9dpt, 9biq, 9wv, 9mc, 9ahj, 9ek, 9oa, 9dwb, 9ahg, 9cc, 9cnu, 9gs, 9ta, 9aex, 9bvv, 9ccm, 9dxu, 9dzo, 9ru, 9amr, 9bij, 9lz, 9cdb, 9bef, 9cch, 9ahq, 9dhl, 9caj, 9bt, 9ef, 9oy, 9dyy, 9veq, 9ceo, 9avw, 9vm, 9bgu, 9db, 9bkr, 9dm, 9aar, 9mc, 9bj, 9ao, 9aw, 9bd, 9dh, 9th, 9dav, 9bq, 9dya, 9dbf, 9cfa, 9dbr, 9ebi, 9cdo, 9afb, 9brx, 9byc, 9lg, 9ccv, 9dw, 9cy, 9bcb, 9wv, 9af, 9ck, 9sa, 9bst, 9ba, 9ry.

All whose calls are listed above please Q. S. L. All cards answered.

The PROUDFOOT

ONE-KNOB VERNIER CONDENSER



13 plate (M.F.C. .00025) **$3.75**

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43 plate (M.F.C. .001) **$5.75**

WHEN you install this condenser on your panel, you are assured of results — regardless of the hook-up you use. Watch-like precision, plenty of strength with minimum bulk are all elements entering into its efficiency. It requires only small space in your cabinet—a mighty profitable quality in a radio unit today when everyone wants a set that "doesn't take up much room."

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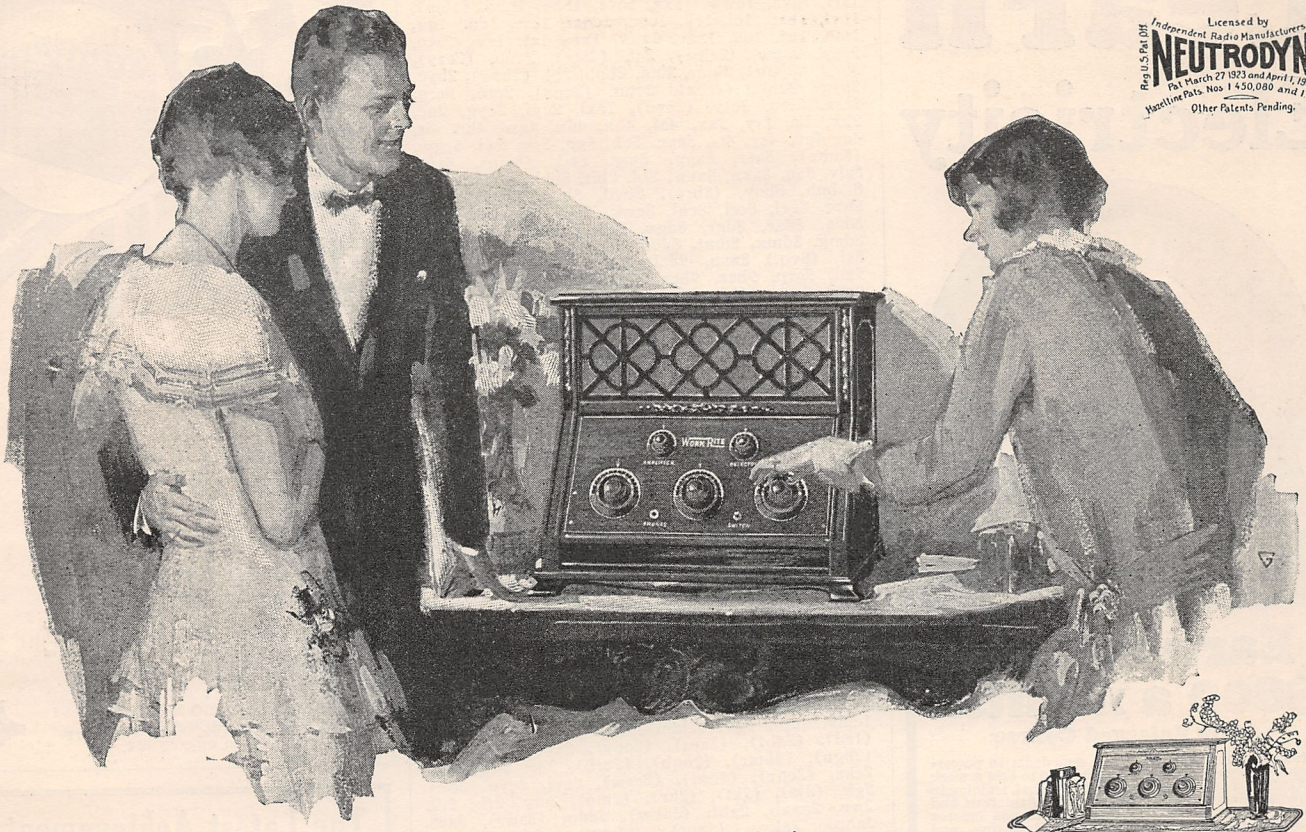

"Can we get those blues from Memphis?" *"Easy! Just turn the dials to 64, Mary, and we'll have 'em right away."*

You never imagined that radio *could be* so sure—so simple to use. Just think! Once you've tuned in a station with WorkRite Super Neutrodyne Receivers, you can turn to it instantly, at any time, simply by referring to your "log."

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WorkRite brings in distant stations—not just once in awhile—but regularly and distinctly on the loud speaker. Under favorable conditions, it will bring in broadcasting from across the continent.

Amazing Selectivity

There's another great WorkRite advantage that you'll appreciate. It's this. No matter how powerful your local stations may be, you can easily tune them out and bring in other stations using practically the same wave length.

The first time you use one of these beautiful, companionable sets, you'll think it's almost magical. But, there's really no secret to WorkRite's remarkable range and selectivity. They are due largely to two things. First—WorkRite's ingenious Super Neutrodyne "hook-up." Second—the way WorkRite is built—the fine materials that go into every set—the intimate, careful attention given to every detail of manufacture.

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WorkRite has already won a host of enthusiastic friends. Dealers in many cities find themselves pressed to meet the demand for WorkRite. So, if the store you visit is unable to demonstrate WorkRite for you, write us and we will send you the name of a store that can. Or, if you want to know more about WorkRite sets before you see them, mail the coupon below and we will send you a beautifully illustrated rotogravure folder giving full information on all WorkRite models.

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DEALERS—If you don't know about WorkRite Super Neutrodyne Receivers, by all means write us immediately for full particulars.

WORKRITE
SUPER NEUTRODYNE RADIO SETS

WORKRITE AIR MASTER

Like all WorkRite models, this is a 5 tube set, encased in genuine brown mahogany cabinet with graceful sloping panel. Almost identical with WorkRite Radio King, shown in main illustration, except the latter has a loud speaker built into cabinet behind a handsome grille. Both furnished with plug and special cable carrying all battery wires.

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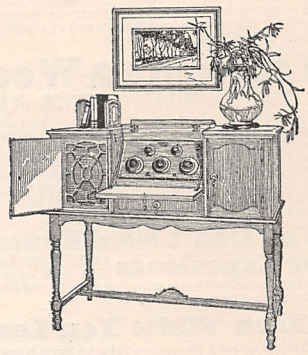

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In this beautiful mahogany console, the loud speaker with special horn and reproducing unit is placed on one side and compartment for A and B batteries on other side. All connections made inside with cable and plug. Front drops, forming arm-rest for tuning or writing. Drawer beneath drop is provided for log sheets, etc. A set unsurpassed in any respect.

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CANADIAN—1bo, 1dj, 2be, 3bq, 3fc, 3nf.

DALITE—1abf, 1aeg, 1asy, 1bcc, 1boa, 1bwj, 1cmp, 1cmx, 1kv, 2apy, 2bgi, 2bgo, 2bjo, 2bqg, 2brb, 2chz, 2cjd, 2cnk, 2cpd, 2cqz, 2cv, 2cvj, 2cxb, 2mo, 2mu, 2rb, 2wz, 4ea, 4ft, 8ago, 8atp, 8bdw, 8brc, 8dtc, 8fm.

3TT—3AAP, PHILADELPHIA, PA.

C.W.—(1aap) 1aj, 1aos, 1app, (1ava), (1avl), 1aww, (1axk), 1axz, 1bbe, 1bcm, 1bgo, (1boa), 1bwj, 1bym, 1cmp, 1cq, 1is, 1kl, 1rr, 1um, 1ww. 8bbx, 2ts, 2wc, 4cs, 4jr, 4tj, 4un, 4vr. 5aw, (8acm), 8akk, 8pan, 8atz, 8bmt, 8bn, 8bnh, (8boe), 8boy, 8brm, 8myi, 8cnl, 8da, 8dga, 8dgo, 8dkl, 8dmt, 8ef, 8em, 8fm, 8fn, 8gz, (8kc), 8rj, 9aau, 9aat, 9baz, 9bcj, 9bof, 9ccj, 9ce, 9cee, 9chs, 9cwp, 9dsa, 9dwb, 9ln.

FONE: 1cke, 2au, 8brc.

Please report on mi 5 watt CW & Fone. All cards answered.

4PV, 148 AVANT ST., SPARTANBURG, S. C.

(1app), 1abf, 1ael, 1ajx, (1all), 1aww, 1azr, 1bcu, 1bdx, (1bgq), 1boa, 1bq, 1bvr, 1bwj, (1cak), 1cmx, 1cpj, 1gv, (1mm), (1pl), 1py, (1rh), 1sf. (1zd), (2abt), (2acs), (2aey), 2al, 2ana, 2ayp, (2bgo), (2bmr), (2bqb), (2brb), 2by, 2cg, 2cjj. 2cka, (2cqz), (2crq), (2crw), 2cvj, 2cvu, 2cwj, 2gk, (2jc), (2kf), (2kr), (2mo), 2my, 2rb, 2rk, 2wz, 2axab, 2xbf, (3abw), 3adp, (3adv), 3aec, 3ahp, 3aky, (3apt), (3apv), 3auv, 3bco, 3be, 3bei, (3bkl), (3bnu), 3bob, (3buv), 3buy, 3bva, (3bvl), (3bvu), 3bwt, 3bz, (3cbx), (3hdk), 3cel, (3chh), 3cjn, 3doo, 3fb, 3fr, 3jh, 3jv, (3lg), (3ly), 3mf, (3oe), 3og, 3ph, 3pi, (3qt), (3sf), (3tf), 3ts, 3xp, (3zm), 3zo, (4aa), 4af, 4ai, 4bg, (4bk), 4bw, (4dt), (4du), 4dv, (4dx), 4ea, 4eq, 4fg, 4fs, 4ft, 4gx, (4gw), (4hr), (4hw), (4hz), (4io), (4it), 4jd, (4jr), 4ll, (4ls), (4mi), (4on), 4pb, (4pd), 4pk, 4rh, (4rr), 4sa, (4si), (4sy), 4tj, 4ua, (4un), 4xx, (5aaj), 5agn, 5aiy, 5akn, (5akw), (5alz), (5amh), (5aom), (5apc) 5ck, 5es, 5fm, (5fv), 5gi, (5gp), 5in, 5iq, (5ka), 5kc, (5nj), 5pa, 5pk, 5ua, 5vv, (5wi), 6avj, (8acm), 8acn, 8aer, 8aey, 8agp, 8aig, 8aip, 8ajh, (8alw), 8anb, 8app, 8apr, (8aq), (8atp), 8avd, (8avx), 8awn, 8aws, (8axf), 8ayw, (8bit), 8bjt, (8bkh), 8bkm, 8blp, 8bma, 8bmb, (8bni), (8boe), 8bos, 8boy, 8bqi, 8bqr, (8brc), 8brm, (8bt), 8btl, 8bvd, 8bvj, (8bvr), 8bvu, 8byk, 8bzf, 8cab, (8cci), 8cee, (8cei), 8dgo, 8chk, 8cia, (8cjp), (8cmh), 8cnl, 8con, (8crw), (8cud), 8cwp, (8cwr), 8cxm, (8cyi), 8cys, (8dae), 8dfm, 8dgt, (8dhs), 8dki, (8dla), 8dmx, 8dnf, 8do, 8doc, 8doi, (8doq), (8dph), 8dpj, (8dqi), (8dsn), 8fj, (8fm), 8gz, 8hc, 8hn, (8hv), (8kj), 8lr, 8md, 8ry, (8sf?), 8vq, 8vt, 8wy, 8xap, 8xs, 8zab, 8zg, (9aa), (9aal), 9aau, 9aps, (9arp), 9aud, (9aus), (9auy), (9azx), (9baz), (9bcc), 9bce, 9bcx, 9bdp, (9be), (9biw), 9bjz, (9bk), 9bkj, (9bkk), 9blr, 9bmk, (9btk), 9bwf, 9bwu, 9cah, 9cco, 9cdv, 9cee, 9cfi, 9cfs, 9cii, 9cmr, 9cnv, (9cwp), 9cyq, (9czb), 9cze, 9dfq, 9dge, (9dgv), 9djn, 9dlm, 9dlw, (9dmi), 9dmj, 9dpx, (9drc), 9dsa, 9dtk, 9dxr, 9ead, (9ebq), 9efz, 9eky, 9elb, 9eld, 9eli, 9em, 9hp, 9kd, (9oa), (9tg), 9tf, 9uc, 9vc, (9xbe), 9xw.

FONE: 2rb, 4it, 4ll, 4rr, 8brc, 8cab, 8xad, 8xs.

NAVAL: nkf.

CANADIAN: 1ar, 3acf, 3fc, 5mb.

F. C. SCOBEY, 478 STUYVESANT AVENUE, TRENTON, N. J.

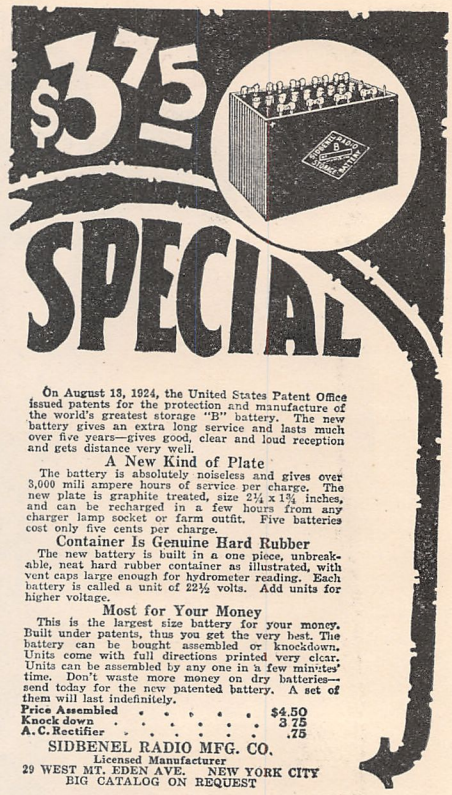
1aac, 1aap, 1caz, 1cf, 1ct, 1jv, 1ask, 1arp, 1tv 1ber, 2cro, 2crc, 2ck, 2sy, 2ava, 2cph, 2cqi. 3's too numerous. 4ef, 4ol, 4m, 5ck, 5up, 5lb, 6at, 8afm 8amc, 8cfp, 8oak, 8aqa, 8anp, 8boa, 8bpn, 8brx, 8bxt, 8os, 8cp, 9ats, 9arp, 9bhh, 9doe, 9sta.

CANADIAN: 2be, 3gg, 3pz, 4hh.

Pse QSL Oms. I will do the same

8PS, 9506 COLUMBIA AVENUE, CLEVELAND, OHIO

1abf, 1ael, 1aja, 1alj, 1all, 1anh, 1are, 1arf, 1axa, 1bcc, 1bdx, 1bes, 1bhm, 1bie, 1bnt, 1bwx, 1bqk, 1ccz, 1ci, 1cdp, 1cmx, 1cqk, 1ctw, 1da, 1db, 1gv, 1ka, 1kc, 1kr, 1my, 1oa, 1oj, 1om, 1rh, 1xae, 1xam, 2acs, 2agd, 2aja, 2awf, 2bgo, 2buy, 2chc, 2chz, 2cmk, 2cpd, 2cpx, 2cqz, 2cv, 2cvj, 2cwj, 2ev, 2wc, 2mu, 3acq, 3adb, 3adp, 3agf, 3ajd, 3anj, 3aoj, 3api, 3apv, 3bay, 3bco, 3be, 3blu, 3bmn, 3bno, 3bnu, 3bta, 3bva, 3mwj, 3cck, 3cjn, 3ckl, 3co, 3hs, 3ke, 3lr, 3me, 3mf, 3oe, 3oq, 3up, 3vw, 3wf, 3xav, 3xx, 3zo, 4af, 4ai, 4cs, 4dx, 4ft, 4fs, 4gw, 4iu, 4jr, 4rr, 4tj, 4xz, 5amf, 5ar, 5cn, 5ck, 5ek, 5no, 5nt, 5vv, 5wo, 5za, 5zas, 6cgw, 6ka, 6xad, 7zu. 8th district too numerous. 9aau,



On August 13, 1924, the United States Patent Office issued patents for the protection and manufacture of the world's greatest storage "B" battery. The new battery gives an extra long service and lasts much over five years—gives good, clear and loud reception and gets distance very well.

A New Kind of Plate

The battery is absolutely noiseless and gives over 3,000 milli ampere hours of service per charge. The new plate is graphite treated, size 2¼ x 1⅝ inches, and can be recharged in a few hours from any charger lamp socket or farm outfit. Five batteries cost only five cents per charge.

Container Is Genuine Hard Rubber

The new battery is built in a one piece, unbreakable, neat hard rubber container as illustrated, with vent caps large enough for hydrometer reading. Each battery is called a unit of 2½ volts. Add units for higher voltage.

Most for Your Money

This is the largest size battery for your money. Built under patents, thus you get the very best. The battery can be bought assembled or knockdown. Units come with full directions printed very clear. Units can be assembled by any one in a few minutes' time. Don't waste more money on dry batteries—send today for the new patented battery. A set of them will last indefinitely.

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Knock down	**3.75**
A.C. Rectifier	**.75**

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The result is a battery of long life, steady voltage, and unequalled capacity. Easily and quickly recharged. Amazingly economical to operate.

It is the greatest step forward in radio batteries—yet the prices are surprisingly reasonable.

Get a Ray-dio "B" Storage Battery and enjoy clear, distinct reception free from disagreeable sounds and disturbances.

Write at once for prices and particulars.

JORDAN BATTERY COMPANY
Dept. 1 Ypsilanti, Mich.

DEALERS: All these things are making the Ray-dio "B" Storage Battery the most sought after radio battery ever made—and dealers everywhere are finding a tremendous demand for them. Absolutely nothing to compare with it. Ask for full details. Don't delay. Be first!

EARN MONEY AT HOME

YOU can earn $1 to $2 an hour in your spare time writing show cards. No canvassing or soliciting. We instruct you by our new simple Directograph System, supply you with work and pay you cash each week. Write today for full particulars and free booklet.

WEST-ANGUS SHOW CARD SERVICE LIMITED
Authorized Capital $1,250,000.00
154 **Colborne Building, Toronto, Can.**

Print Your Own

Cards, circulars, labels book, paper. Press $12. Larger $35 Job press $150. Save money Print for others, big profit. All easy, rules sent. Write factory for press catalog, TYPE, cards, etc. **THE PRESS CO., D-72 Meriden, Conn.**

EXCELSIOR

"BUILD YOUR OWN" WITH "RASCO" PARTS!

Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

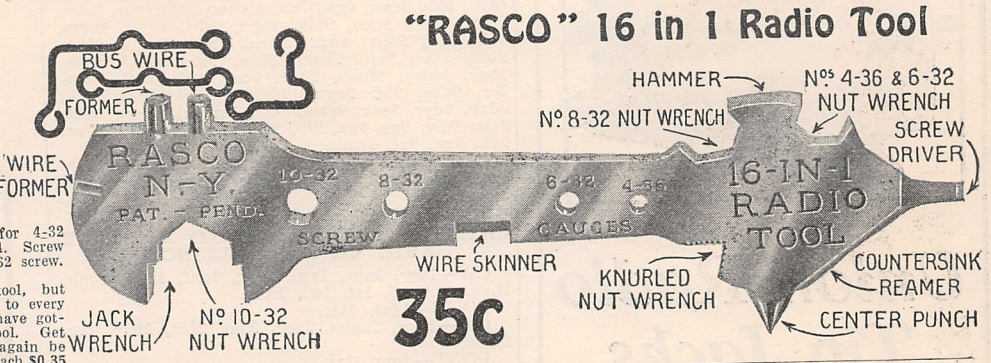
NEW AND EXCLUSIVE "RASCO" GOODS

Money refunded if goods do not satisfy

"RASCO" 16 in 1 Radio Tool

HERE it is! The radio tool that will bring happiness to all radio experimenters and constructors. Here is a tool that does 16 different things and does them well. A tool that does practically everything required in building your radio set. The tool is built of hardened steel, size exactly as per illustration, highly finished. Here are some of the uses: 1. Screwdriver. 2. Center punch. 3. Countersink and reamer. 4. Bus bar wire bender. 5. Bus bar and wire bender for 8-32 screw. 6. Bus bar and wire bender for 6-32 screw. 7. Socket wrench for jacks. 8. Socket wrench for 4-36 nuts. 9. Socket wrench for 6-32 nuts. 10. Socket wrench for 8-32 nuts. 11. Wrench for knurled nuts. 12. Screw gauge for 4-32 screw. 13. Screw gauge for 6-32 screw. 14. Screw gauge for 8-32 screw. 15. Screw gauge for 10-32 screw. 16. Knife for wire skinning.

These are only the important uses of the tool, but many other uses will readily suggest themselves to every radio experimenter. You will wonder how you have gotten along before without the 16 to 1 radio tool. Get one of these happiness tools. You will never again be without it. **N-4800** RASCO 16 to 1 Radio Tool, each **$0.35**



CRYSTODYNE DETECTOR

(PATENTS PENDING)

Here is a detector which has been especially developed by us for the new **Crystodyne** circuits. This detector while using the natural mineral zincite can be used with any other crystal as well. Several unique features are embodied in this detector. To begin with it is the only detector that has a **sliding crystal cup** with perfect contact arrangement and which cup not only slides but rotates with an eccentric motion. (Note slot A). By means of the small knob the cup slides easily so that any point of the crystal can be brought into contact. A new crystal can be inserted immediately by unscrewing the small knob. The contact plate which at the same time forms the catwhisker is made of spring steel. The combination of **steel-zincite** is the only one that was found practical for the Crystodyne oscillating crystal. Note the micrometric adjustment that can be made by means of the large knob bearing against the steel spring. This raises and lowers the steel point to the finest possible degree. The base is of bakelite, all parts nickel plated and polished.

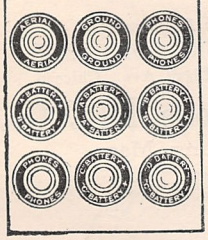
N6900-Crystodyne Zincite Detector with Crystal.....**$1.75**

N6900-Natural Zincite Mounted Crystal especially tested for Crystodyne work, fits any crystal cup **$0.60**

"RASCO" Snap Switch

At last a REAL radio switch constructed for radio purposes, not just a battery switch that may be adapted for radio. The RASCO switch is the only switch with a POSITIVE DOUBLE spring action. No more guess work if the circuit is open or closed. A push of the finger and the current is on. A slight pull and **The Handle Snaps Back** of its own accord. An internal coil spring pushes the handle back when a little pull is applied. This switch is intended as a battery switch to disconnect your "A" batteries. Only one hole to drill. **No tools required** to mount only your finger and thumb. Also this switch takes up a minimum of room, much less than other switches, the base of the switch measuring only 1¼x1½". All metal parts nickel plated. A switch you will be proud to possess. **N4850-RASCO Snap Switch. Each 25c**

"RASCO" NAME PLATE ASSORTMENT No. 4994



This Name Plate Assortment Packet contains Nine Binding Post Name Plates as follows: one Aerial; one Ground; two Phones; one "A" Bat. —; one "B" Bat. +; one "A" Bat. + "B" Bat. —; one "C" Bat. +; one "C" Bat. —.

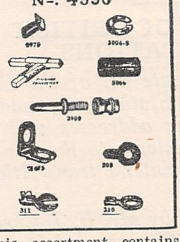
N4994 Nine Name Plate Assortment **$0.20**

"RASCO" LUG ASSORTMENT 50 LUGS 5 DIFFERENT STYLES No. 4995

This Lug Assortment Packet contains fifty of the most important lugs for the man who "Builds His Own" as follows: 10 lugs for 8/32; 10 for 6/32; 10 prong lugs (solderless) 6/32; 10 ditto 8/32; 10 flat type 6/32. All lugs are tinned.

N4995 Lug Assortment **$0.22**

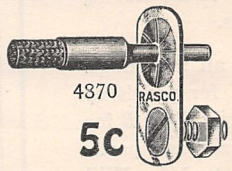
"RASCO" RADIO NEEDS ASSORTMENT 108 PIECES No. 4996

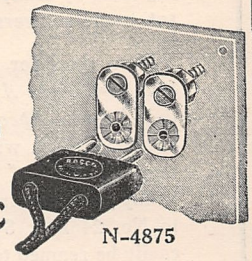


This assortment contains 108 pieces as follows: 36 "T" Wire Bus-Bar Connectors; 4 Adapter Bushings (to fit ¼" dial to 3/16" shaft); 4 Separable Phone Tips; 4 Angle Brackets; 24 Lock Washers; 36 Assorted Lugs, already tinned for easy soldering.

N4996 "RADIO NEEDS" Assortment **$0.48**

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs





Again, Rasco leads with a small but important radio novelty. JIFFY JACKS are the simplest, and most efficient Cord Tip Jacks ever designed. Stamped from a single piece of metal they grip any style cord tip from any make phone or loud speaker. The JIFFY JACKS take but a minimum of room. All you need do is to drill two small holes in your panel and mount the JIFFY JACK with screw and nut furnished. **No soldering necessary** as the wire goes right on the screw. X-ray view shows how two of the jacks are used in conjunction with our **Jiffy cord plug.** The jacks go on in back of panel, only screws show in front. JIFFY JACKS take practically no room when mounted and are made of best spring brass that will not wear out. Hundreds of other uses for our JIFFY JACKS. **We will pay $1.00 for every new use for JIFFY JACKS that is accepted by us.**

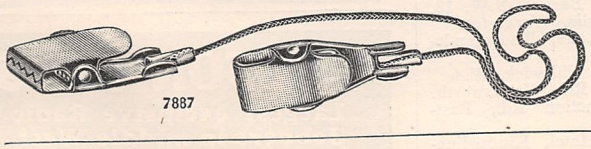
JIFFY PLUGS are made of semi-hard rubber into which the tips of your phones or loud speaker are pushed. The cheapest and simplest plug ever designed. Its small size and neatness made it famous over-night. Size 1 in. long, ½ in. wide and ⅜ in. thick. No tools required. Just wet the metal **cord tips** and push through openings. Plug can be used with any standard cord tip jack, but best with RASCO JIFFY JACK.

N4875-Two **Jiffy Jacks** with nuts and screws and one **Jiffy Cord Plug**.....**$0.20**

N4870-One **Jiffy Jack** complete with nut and screw 0.05

N4871-**Jiffy Jacks** without nuts or screws, two for 0.05

N-4860-**Rasco Jiffy Plugs**, each..... 0.10



"RASCO" Clip Leads

Here is something that every experimenter has been waiting for impatiently. This is a flexible silk-covered conductor to the ends of which are **soldered** strong brass spring clips.

Instead of using wires to make your connections—screwing and unscrewing binding posts—a clip lead hooks in a jiffy onto any wire, any binding post or other conductor in order to make a safe experimental connection.

"RASCO" CLIP LEADS come in two colors, green and red, to distinguish connections. Brass clips have powerful grip. Length of clip lead, one foot.

N7887 RASCO CLIP LEADS. Each..**$0.12**

Dozen lots **1.35**

"RASCO" Brackets

Here is a line of small brackets evolved especially for the man who "Builds His Own." They can be used in a number of different ways—to hold tuning coil tubes; inductances; spider webs, etc.; to hold up panels; to attach various instruments to baseboards, etc. "Rasco" brass brackets are stamped from heavy metal and have been designed to do the work right. They are nickel-plated and carefully finished.

All illustrations are exactly half-size. Every builder needs at least a dozen of these. Order them now and save money and effort.

N1475 Brass Angle Piece, 5/16" wide x 7/16" high. Each.....**$0.03**

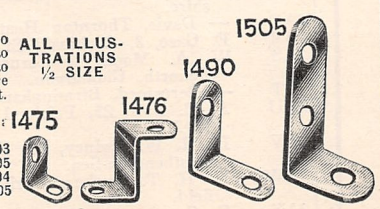
N1476 Brass Bracket, ¾" high x 2 lugs ½" long. Each..... .05

N1490 Brass Angle Piece, size ¾" x ¾". Each..... .04

N1505 Brass Angle Piece, size 1½" high x ⅝" long..... .05

Dozen lots, each style 15 percent discount.

ALL ILLUSTRATIONS ½ SIZE



SEE OUR 2-PAGE AD ON PAGES 652 AND 653, RADIO NEWS

Dealers and Jobbers

Write or wire for territory that is still open on the specialties described on this page. These articles are widely advertised and you will have a demand for them almost immediately.

We shall be glad to send samples to responsible and rated concerns. Address all wholesale inquiries to

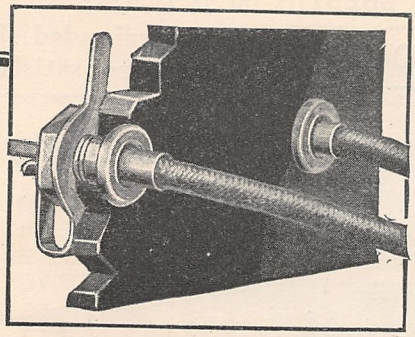
RADIO SPECIALTY COMPANY
Wholesale Department
25A West Broadway, New York City

RADIO SPECIALTY CO., 98 Park Place, New York City

Factories: Brooklyn, N. Y. Elkridge, Md.

This advertisement Copyright, 1924, by R. S. Co., N. Y.

Just Plug In



Union Radio Tip Jacks

25c a pair

The greatest little part in all radio — the height of ease and convenience, just what you need when building sets or trying new hook-ups. Replaces binding posts and gives quick, positive, electric connections. Just plug in. Heavily nickeled, they add to the appearance of your set.

Because of superior merit over binding posts, they are now being used by many of the leading set manufacturers.

Two sizes for all mountings. *Standard Type A* for panels up to ¼" thick. *Special Type B* for panels, cabinet walls and partitions from 5/16" to ½". Will firmly grip all wires from No. 11 to No. 24 B & S Gauge. Can easily be reamed to hold antenna wire.

Other Guaranteed Union Radio Parts

TUBE SOCKETS of highly polished moulded condensite. Phosphor bronze contact springs. Reinforced bayonet slot. For all standard tubes. **Price 70c**

DIAL ADJUSTERS for minute adjustment of dials, necessary for close tuning. **Price 60c**

RETAILERS— WHOLESALERS

Write for free samples of our guaranteed reasonably priced Quality Radio Products. Get details of our dealer proposition. Also write for your copy of our Catalogue H.

UNION RADIO CORPORATION
200 MT. PLEASANT AVENUE, NEWARK, N.J.
NEW YORK OFFICE — 116 WEST 32nd STREET.

9aft, 9alb, 9aqd, 9arr, 9arw, 9axu, 9baz, 9bcb, 9bgn, 9blg, 9blr, 9bpd, 9brk, 9bve, 9bzp, 9cee, 9cii, 9cip, 9cln, 9czb, 9dbf, 9dcp, 9dda, 9dhq, 9dlz, 9dol, 9drr, 9dsg, 9duc, 9dyy, 9efz, 9elb, 9es, 9gs, 9my, 9qm, 9qr, 9ss, 9su, 9ta, 9uc, 9zt.

CANADIAN:—1ar, 2bn, 3cg, 3aa, 3adp, 3bq, 3gg, 3hh, 3ly, 3ni, 3oh, 3vh, 3wv, 3yk, 4hh, 9al, 9bp.

1CV, SOMERVILLE, MASS.

C.W.—1's, 2's and 3's too numerous. 4aa, 4ai, 4ea, 4er, 4ft, 4ih, 4mb, 4na, 4oa, 4pk, 4sh, 4xc, 5ajb, 5alv, 5cn, 5da, 5dm, 5qy, 5rv, 5ue, 5zav, 6arb, 6bh, 6cmr, 6gt,, 7co, 8's too numerous, 9aau, 9aav, 9adp, 9aen, 9afy, 9ago, 9ahj, 9ajw, 9amp, 9hk, 9ell, 9aza, 9azx, 9bcx, 9bdq, 9bgh, 9bhh, 9bib, 9biz, 9zjf, 9bmu, 9bpt, 9brx, 9bsj, 9btk, 9bvz, 9bwp, 9bwu, 9bye, 9caa, 9cii, 9cfl, 9cog, 9cr, 9cvs, 9bf, 9cyw, 9dds, 9dhr, 9dlw, 9dwk, 9dxu, 9dyr, 9eak, 9eam, 9ear, 9ei, 9eja, 9eeg, 9eer, 9ela, 9elv, 9gs, 9gz, 9lb, 9le, 9ma, 9mc, 9qr, 9vc, 9vk, 9zn, 9zt, 9vau.

CANADIAN:—C.W., 1bz, 2bz, 2bv, 2fu, 3db, 3ix, 3vh, 3wv, 3yv, 3fz. Qsl'e appreciated and answered.

ANTHONY C. TOMCZAK, 2649 N. DRAKE AVE., CHICAGO, ILLINOIS

CW—1agr, 1aiw, 1anj, 1aoc, 1axt, 1bdd, 1bnh, 1bpa, 1dr, 1jl, 1sf, 1wi, 1xas.

FONE—1axt, 1cte.

CW—2ahg, 2amm, 2aoc, 2aut, 2bct, 2buo, 2oe, 2mu.

FONE—2mu, 2xi.

CW—3aev, 3cr, 3lq.

DALITE CW—3ul.

CW—4bc, 4ek, 4ks (qrz in Feb. qra?).

CW—5aaq, 5acd, 5aej, 5alu, 5amq, 5ap, 5do, 5eh, 5ei, 5et, 5ho, 5jx, 5kc, 5oe, 5mo, 5nk, 5nm, 5om, 5pf, 5pi, 5pn, 5qa, 5rp, 5rz, 5sf, 5sx (qra?), 5tj, 5tn, 5ts, 5tx, 5uo, 5up, 5vh, 5vs, 5wx, 5xab, 5xh, 5yt, 5zx.

FONE—5aaq, 5st, 5xab.

CW—6ajx, 6awp, 6cmp, 6xad.

FONE—6xad.

CW—7abo, 7ade, 7akw, 7gd, 7ht, 7rp, 7uf.

FONE & CW (NO LOG KEPT OF 8's), 8acn, 8add 8aee, 8afm, 8agg, 8ais, 8ajg, 8ak, 8akw, 8amb, 8amq, 8aod, 8apr, 8arb, 8aru, 8asj, 8atp, 8avd, 8awl, 8axf, 8azf, 8bab, 8bcn, 8bdy, 8bej, 8bgw, 8bjd, 8bkh, 8bl, 8bnh,, 8bos, 8boy, 8brc, 8brk, 8bro, 8bt, 8bvr, 8bym, 8cak, 8ccj, 8ceb, 8cfe, 8chg, 8cjl, 8cjp, 8cki, 8cmu, 8con, 8cpk, 8csa, 8cub, 8cwq, 8cxn, 8czx, 8dae, 8dcw, 8ddj, 8ddx, 8dec, 8dfe, 8dfm, 8dgo, 8dir, 8dkm, 8dt, 8fs, 8hn, 8in, 8ki, 8kj, 8kn, 8nb, 8nc, 8nk, 8ns, 8qv, 8rj, 8rt, 8sm, 8tv, 8uf, 8wa, 8wo, 8xap, 8xbj, 8zg, 8zj, 8zo, 8zad, 8zag.

CW FONE & ICW (NO LOG KEPT OF 9's), 9aa, 9aad, 8aaj, 9aaw, 9aax, 9abk, 9abp, 9abs, 9ac, 9acj, 9acq, 9ae, 9ael, 9afe, 9agq, 9ahd.

REVISED LIST OF BRITISH AMATEUR STATIONS

The following up to date list of the calls of the British Amateur Stations, the names of the owners and their addresses will no doubt be of material assistance to the American Amateurs in this winter's trans-Atlantic transmissions.

This list was compiled by Mr. F. T Carter of Streatham, London. We are indebted to him for his kindness, and allowing us the opportunity of publishing it.—Editor.

2AA	Radio Communication Co., Ltd., Slough.
2AB	Capt. de A. Donisthorpe, London.
2AC	Metropolitan Vickers Co., Ltd., Altricham, Manchester.
2AD	Siemens Bros. & Co., Ltd., Woolwich.
2AF	A. R. Taylor, 49, Idmiston Rd., S.E. 27.
2AG	T. Moor, Lethbridge, Rd., Southport.
2AH	A. R. Taylor, Oxford.
2AJ	Radio Comn. Co., Ltd., Barnes, S.W. 13.
2AK	R. M. Radio, Ltd., Diglis, Worcester.
2AL	W. Halstead, Briar Lane, Thornton-le-Fylde.
2AM	A. Perl, 5, Sharon Rd., Chiswick, W.4.
2AN	A. Sharman, 1, Morella Rd., Wandsworth.
2AO	O. H. Relly 26, Junction Rd., Eastbourne.
2AP	F. Adams, Alexandra Hotel, Kincardineshire.
2AQ	— Davis, Thornton Heath.
2AR	E. Gaze, 3, Archibald St., Gloucester.
2AS	W. A. Moon, 2 Cornerswell Gardens, Penarth, Glamargan.
2AT	— Beresford, Birmingham.
2AU	A. C. Bull, 25, Fairland Rd., W. Ham, E.15.
2AV	D. H. W. Swiney, 18, Southchurch Rd. Southend-on-Sea.
2AW	H. H. T. Burbury, Crigglestone, Wakefield.
2AX	G. Sutton, 18. Melford Rd., S.E.22.
2AY	D. F. Owen, Limehurst, Sale, Cheshire.
2AZ	William Le Queux, St. Leonards-on-Sea.
2BA	Finsbury Technical College, Leonard St., E. C. 2, London.
2BC	D. F. Owen, Limehurst, Sale. Cheshire.
2BD	Aberdeen Station of B. B. Co., Ltd.
2BE	British Broadcasting Co., Belfast.

$5
One Model
One Quality
In Canada
$7

Globe Phones

America's Best Headset regardless of Price

We challenge comparison with America's best known headphones. Globe Phones always show up best where the opposition is greatest. And the quality is there to last for years.

There is long experience in making hearing aids for the deaf behind the amazing tone purity and reaching qualities of Globe Phones.

As beautiful as they are efficient. Leather covered head bands, heavily nickeled parts, extra powerful magnets. If your dealer fails you, write us.

For Dealers Who Hope to Stay in Radio

Globe quality is so extraordinary and the price so moderate that worth while customers will never expect price cutting. So we offer dealers a future in phones.

Sales Department
THE ZINKE COMPANY
1323 S. Michigan Ave., Chicago

Globe Phone Mfg. Co.
Reading, Mass.

GLOBE
TRADE MARK

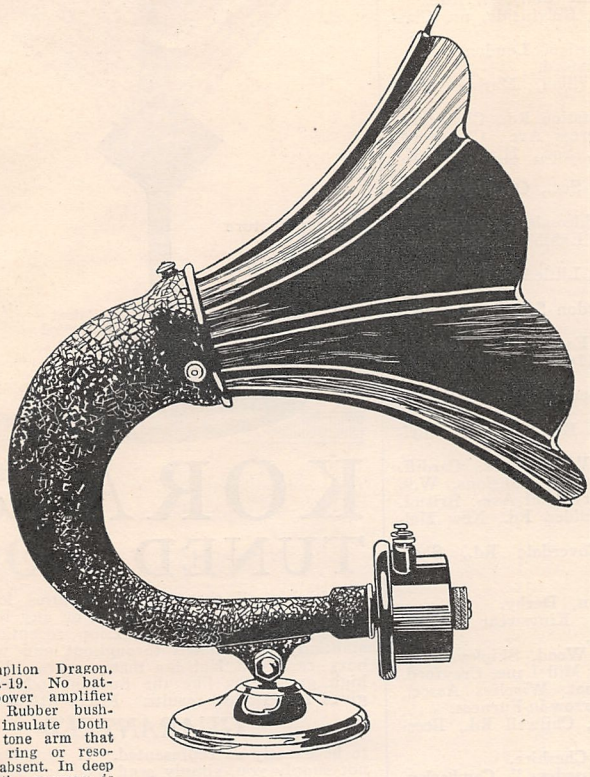
"Globe Helps the World Hear — Even the Deaf"

HUDSON-ROSS
Largest exclusive Radio Jobbers in middle West.
Write for discounts.
123 W. Madison St. Chicago

Perpetual Radio Fuse $2.50
$100.00 reward if you can blow your tubes with this protector in your circuit according to our instructions.
SUPER ULTRADYNE Transformers, complete set including blue print $16.00
ULTRA SYNCHRODYNE Coils, set of three.....$7.00
Including blue print. With condensers.....$17.00
DEALERS and JOBBERS we have an attractive territory proposition.
THE STANLEY RADIO COMPANY, Manufacturers.
2947 Lorain Avenue Cleveland, Ohio

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

ENGLAND - SCOTLAND - WALES - IRELAND - NORWAY - SWEDEN - DENMARK - HOLLAND - BELGIUM - FRANCE - SWITZERLAND - SPAIN - ITALY



The Amplion Dragon, Model AR-19. No battery or power amplifier required. Rubber bushings so insulate both horn and tone arm that distortion, ring or resonance are absent. In deep full tones the program is reproduced in your home as given in the studio. adjustable mechanism permits "tuning" the Amplion to your set. The nickeled base is also adjustable.

Europe first acclaimed it the finest loud speaker

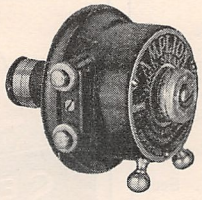
Edward Alfred Graham, of Alfred Graham & Co., the originators and oldest makers of loud speakers, is the inventor and patentee of the Amplion. Mr. Graham is regarded throughout foremost nations, as the greatest living authority on the reproduction of sound waves.

NOW AMERICA IS ENTHRALLED BY ITS INCOMPARABLE PERFORMANCE

This is to invite you to hear the loud speaker which has captured all Europe. And no music lovers are more critical than they. So it is conclusive that, abroad, Amplions overshadow in popularity all other loud speakers combined.

We urge you, with your own ears, to learn why. To hear what the oldest manufacturer of loud speakers offers. To compare, most critically, this time-perfected development for radio of a famous electro-magnetic and acoustic instrument. An instrument which leading navies have used for thirty years.

We promise you a new conception of how good loud speaker reception can be. You will never know the real merit of your set until you hear it over an Amplion. Go, today, to your dealer's for this treat. Let your ears decide.



The Amplion Phonograph Unit, Model AR-35, utilizes the horn of your phonograph. Produces great volume without battery or power amplifier. Mechanism is adjustable—permits "tuning" the Amplion to your set.

The Amplion comes in models for the average home, the large home and for auditorium use. Also in phonograph units. Literature on request.

THE FLOATING DIAPHGRAM of THE AMPLION

(Patented)

One of numerous patented features which account for the Amplion's incomparable sensitiveness, purity, clarity and naturalness of tone. The Amplion vibratory diaphragm is solid instead of perforated. It is cushioned and kept from contact with metal by rubber gaskets. It rests on a narrow ledge, lightly held there by a spring ring with just enough pressure to prevent "chatter" when extreme volume is desired. The result is that the diaphragm "floats," free from strain, stress or undue tension, free from contact with any metal parts, and free to vibrate in exact accord with the variations of current flowing through the operative windings of the electro-magnetic system. As a consequence, faithful reproduction throughout the entire musical scale is obtained —*without distortion.*

THE AMPLION CORPORATION OF AMERICA
280 MADISON AVENUE, NEW YORK CITY

Obtainable from all high grade Radio Dealers

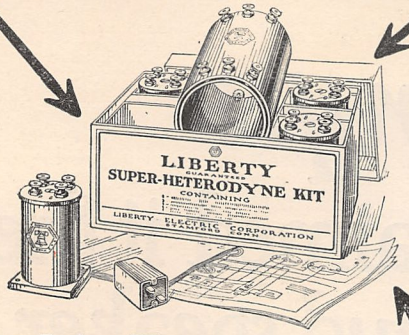
Canadian Distributors: Burndept of Canada, Ltd., 172 King St. West, Toronto.

AMPLION

The World's Standard Loud Speaker

UNITED STATES - - CANADA - - JAPAN - - INDIA - - SOUTH AFRICA - - NEW ZEALAND - - AUSTRALIA

Build Your Own Super-Heterodyne



It's Easy

The low price of the Liberty Super-Heterodyne Kit—only $27.50—with the low cost of other standard parts required to make a complete receiver, brings this greatly improved type of equipment within easy reach of all.

You can easily build your set to an exact duplicate of a very successful laboratory model. Each kit contains, without extra charge, simple wiring diagrams, complete detailed assembling instructions, and list of additional parts required. Write today for our FREE instructions and see for yourself.

A super-heterodyne assembled around a Liberty R-40 Kit is the utmost in radio receivers. You get the greatest selectivity, accurate tone reproduction, and greatly increased range, and still, the tuning is extremely simple.

All stations may be logged and a 17" loop is all required for far as well as near stations. Liberty units are accurately balanced before packing in the sealed carton. That, combined with our complete plans, enables us to fully guarantee the R-40 Kit.

Liberty Kits are the product of a well established concern with long experience in building this type of equipment. (We are now filling an important United States Signal Corps super-heterodyne contract).

Your dealer should be able to supply you. If not, order direct and give your dealer's name. Immediate shipment—pay the postman on arrival of kit.

FREE Write for full data, assembling instructions, etc., for building your own super-heterodyne. Send your dealer's name.

Department 211

Liberty Electric Corp.
Stamford, Conn.

fits any Grid Leak mounting

FRESHMAN PLUNGER TYPE VARIABLE GRID LEAK

was designed especially for the non-technical set owner who can replace in an instant the fixed grid leak with this new, efficient cartridge type Variable Grid Leak: without requiring the change of a single wire.

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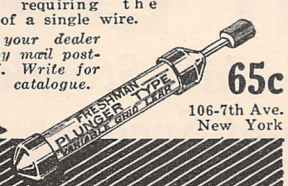

65c

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2BP	Daimler Motor Co., Kelvinside, nr. Glasgow.
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2DN	M. M. Durnford, Kingswear House, Kingswear, Devon.
2DR	S. R. Wright, Mab Wood, Shipley.
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2DV	Woodall, Bramhall, Cheshire.
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2DY	F. H. Haynes, 5, Regent Sq., W.C.1.
2DZ	F. H. Haynes, 26, Avenue Rd., N.15.
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2FA	F. Bennett, 16, Tivoli Rd., Crouch End.
2FB	W. Ison, 80, Harnham Rd., Salisbury.
2FC	D. Sinclair, 19A, Ladbroke Gdns., W.11.
2FG	L. McMichael, 32, Quex Rd., N.W.6.
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2FU	E. T. Manley, Arthur Rd., S.W.19.
2FW	D. Thomas, 45, Chatsworth Rd., Bournemouth.
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2FZ	Manchester Wireless Society (Hon. Sec. 2, Parkside Rd., Manchester).
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2GF	J. V. Newson, 139, Ormside St., S.E.15.
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2GI	— Johnston, Hind House Lane, Sheffield.
2GJ, 2GK	L. Johnston, 5, Hagg Lane, Sandygate, Sheffield.
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2GN	Halifax Wireless Club, Clare Hall, Halifax.
2GO	L. Bland-Flagg, 61, Burlington Rd., W.2.
2GP	W. Gartland, 14, Baalbec Rd., N.5.
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2GR, 2GS	T. Forsyth, "Wenslea," Ashington, Northumberland.
2GT	G. Irvine, 12, Treborth St., Liverpool
2GU	Halifax W. Club, Clare Hall, Halifax.
2GV	W. P. Rigby, St. Lawrence Vic., Bristol.
2GW	A. Cash, Foxley Mount, Lymm, Cheshire.
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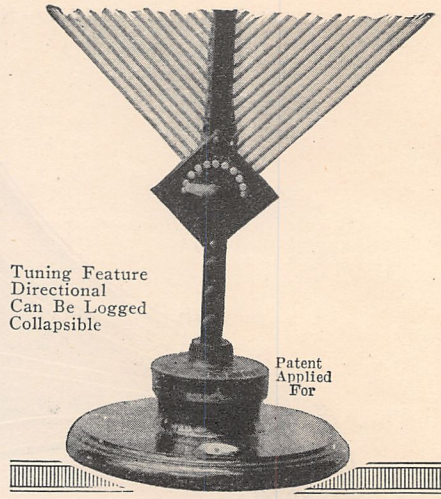

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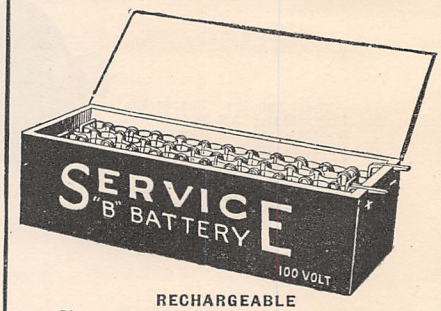

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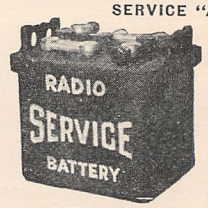

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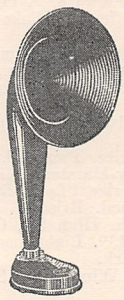
New Radio Triumph

Have you ever noticed how often a baritone solo sounds like a bass in a loud speaker concert? How a violin will sound like a cello? How a soprano will deepen into a mezzo or a contralto?

There is an easily understood reason for this. Sound, passing through a funnel, tends to lower its register. Speak through a megaphone and see how much lower your voice sounds.

Radio engineers have recognized this loud speaker problem—but it remained for the famous Dictograph sound-scientists to solve it. Into the problem they put their 20 years' experience in the making of sensitive sound instruments—the Acousticon for the deaf; the Detective Dictograph and the loud speaking Interior Telephone.

The Upright



Beautiful concert model, finished in attractive etched ebony. Easily hooked in on any set without extra batteries.

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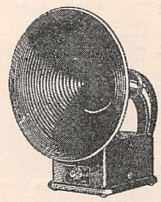
Out of three years continuous experiment came the Dictograph Loud Speaker — the new type loud speaker based on principles which ultimately every maker must adopt. The Dictograph incorporates two vital fundamentals — an articulating device and an acoustically perfect horn which counterbalance any tendency for sound to drop down out of its intended register. Every tone rings true and accurate; the range is wider; articulation decisive and annunciation clear as a lark's call.



Portable Model made with same principles as the Upright, with slightly smaller and curved horn.

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The Dictograph gives you, without rasp, distortion or metallic harshness of any kind, all that your receiving set can take out of the air; the most delicate tremolos, the thunderous overtones; the light and swift harmonics and soft gradations — all voiced as accurately as though the artist were in the room.

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THE "DE LUXE" is new among Neutrodyne sets. Our engineers have taken time to study and to compare constructions and performance. They have discarded weaknesses and adopted only the strongest, most efficient features. The new "De Luxe" is now the superlative realization of months of preparation. It achieves the outstanding quality which the whole world of fans have waited for. It has created enormous demand permitting sale at far below all customary ideas of value. We have low priced it for the multitudes.

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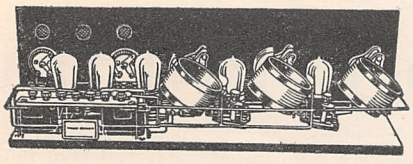

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20 Feet Tinned Bus-bar.
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1 Tubular Glass Grid Leak.
1 Set Engraved Binding Posts.
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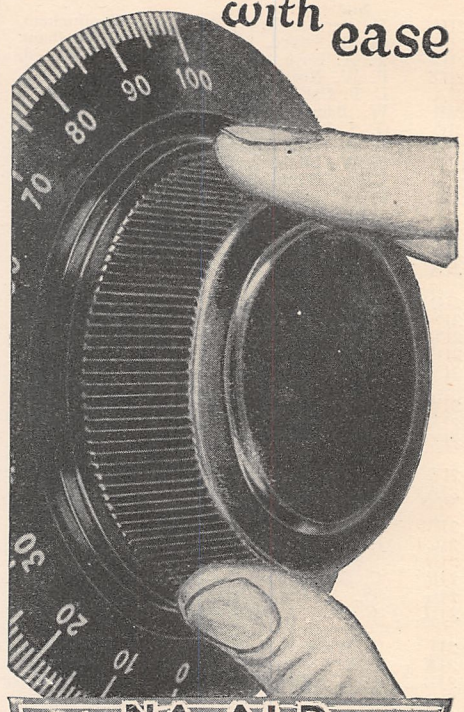

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Super DeLuxe Dials

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Test this dial with any other and see how much more quickly you can turn to any degree or fraction of a degree.

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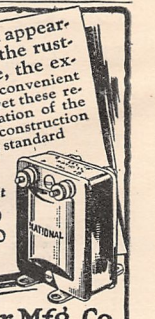

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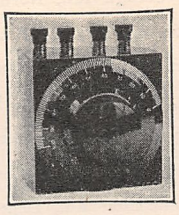

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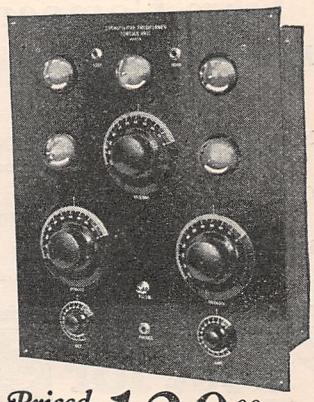

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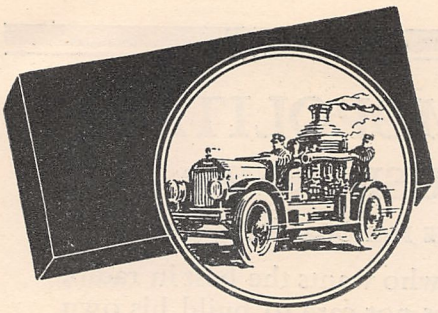

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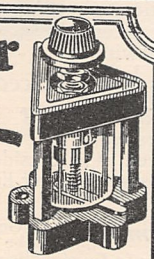

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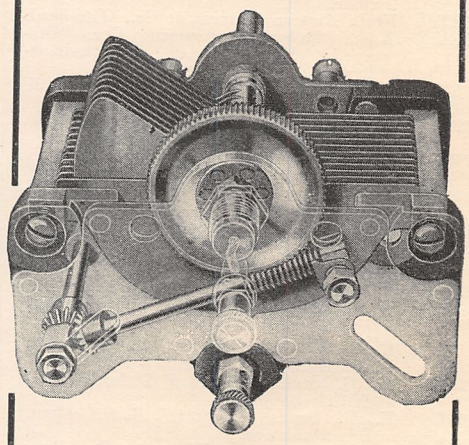

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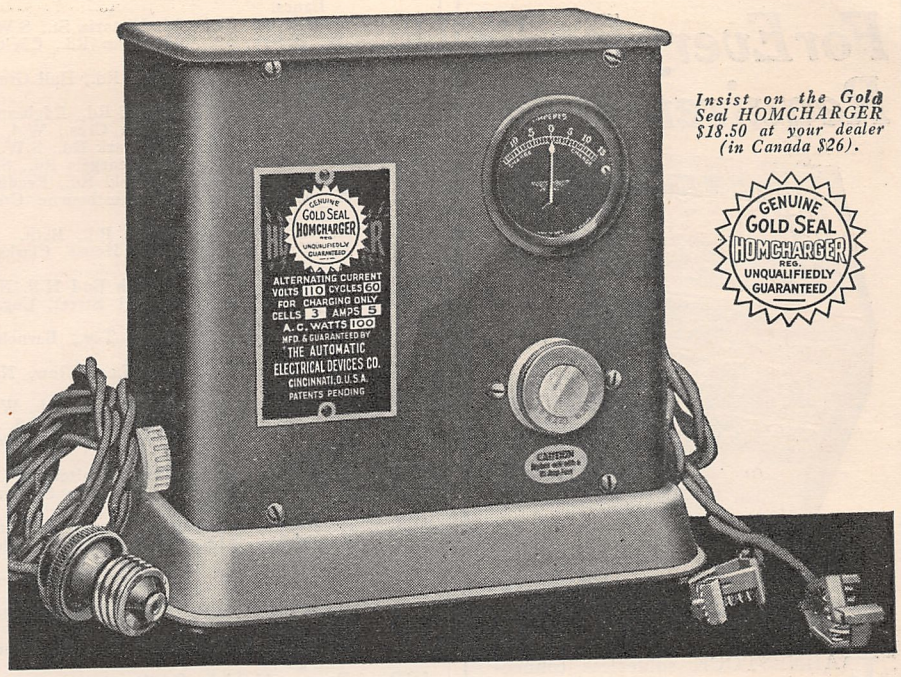

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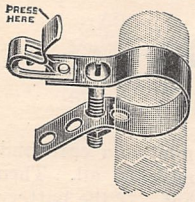

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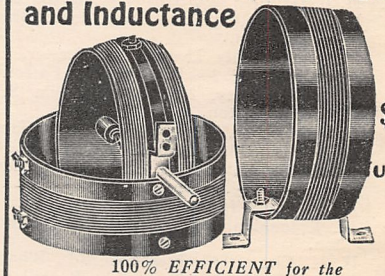

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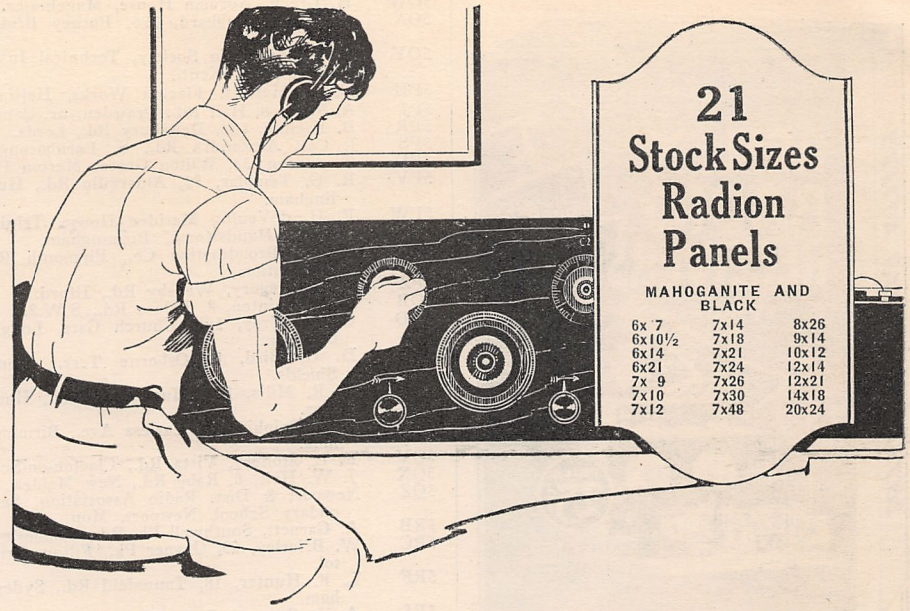

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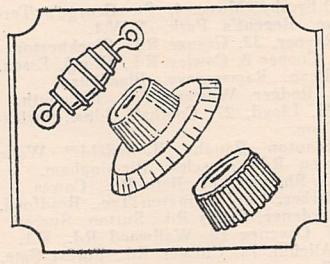

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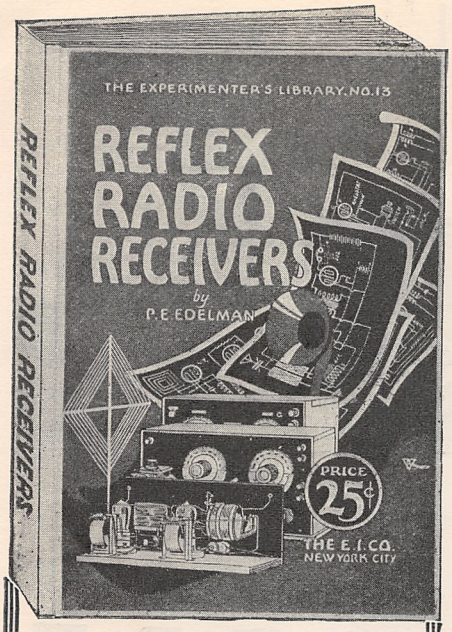

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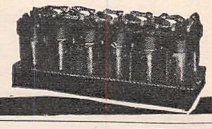

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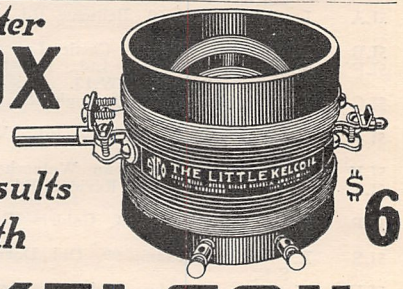

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5WZ	E. W. Hettich, 1, King St., Jersey.
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5XN	H. W. Everett, 30, Gourock Rd., Eltham.
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5XS	F. B. Thomas, 7, Mornington Villas, E. 11.
5XT	P. B. Thompson, 1, Chase Side Pl., Enfield.
5XU	T. N. Lord, 6, Trafalgar Tce., Dewsbury.
5XY	J. C. Harrison, 10, Lake Rd., Lytham.
5XZ	A. F. C. Boyes 48, Lavender Gdns., S.W.
5YB	G. Thompson, East Regton, East Keswick, Leeds.
5YD	E. Bridgewater, 28, Frederick St., Widnes.
5YI	A. L. Goodliffe, 17, Malvern Rd., Matterly.
5YL	B. Hesketh, Ltd., Naylor's Estate, Slough.
5YM	E. H. Robinson, "Langmead," Pirbright.
5YQ	J. Gallocher, 4, Havelock Terrace, Paisley.
5YS	C. H. Dyke, Streetebrooke Road, Shirley, Birmingham.
5YW	R. S. Whitewell, 62, Spon End, Coventry.
5ZF	K. W. F. Townsend, 48, Gt. George St., Leeds.
5ZH	T. Allison, 127, Fulham Rd., S.W.
5ZO	W. F. Mills, 11, Stoney Hey Rd., Brighton.
5ZR	F. H. Austen, St. Peters, Broadstairs.
5ZT	E. Edwards, 18, Ripon St., Moss Side, Manchester.
5ZV	W. Herring, 221, Newark Rd., Lincoln.
5ZX	T. L. Rawson, "Maudsley House," Preston.
5ZY	L. Headlam, Stakesby Rd., Whitby Yorks.
5ZZ	H. C. Whitby, The Ness, Winsford.
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6AG	W. H. Fortington, 237, Dudley Rd., Birmingham.
6AH	R. H. P. Collings, 4, Dean Place, Liskeard, Cornwall.
6AI	H. Andrews, Cynlais Garage, Ystradgynlais, Swansea.
6AJ	G. Ensoll, 25, Victoria Rd., Dukinfield, Ches.
6AL	J. P. Morten, 49, Weston Hill, Upper Norwood.
6AO	A. Ruddlesden, Wakefield Rd., Dewsbury.
6AP	J. A. Hobson, Berkswell, Coventry.
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6AW	E. J. Jarvis, "Naseby Cottage," Waltham Cross.
6BB	J. Bolt, Crouchley, Lymm, Warrington.
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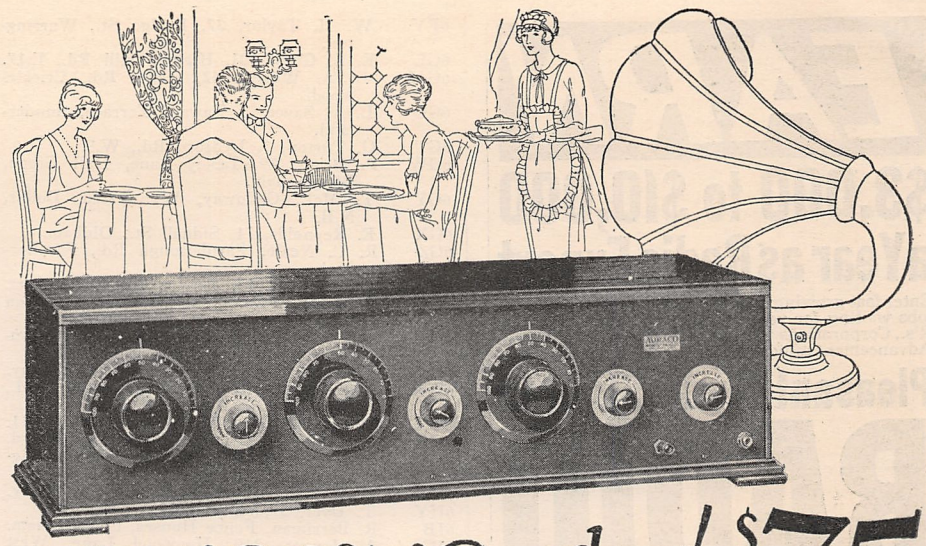

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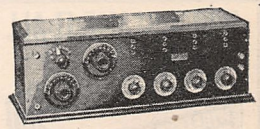

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In eight nights I have heard 42 stations on my Miraco over a phonograph attachment.—Earl Sheldon, Morgantown, W. Va.

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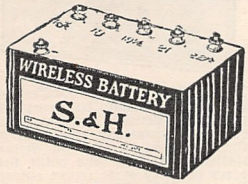

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6RY	H. L. Bowen, 13, Daniel St., Bath.
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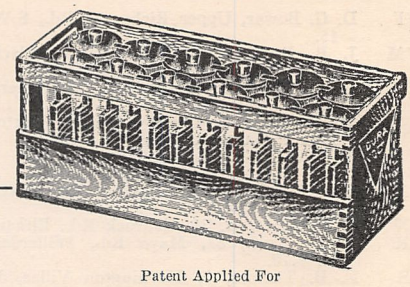
6SG	L. W. Mant, 35, Jessie Rd., Southsea.
6SK	A. E. Vollner, 57, Lyttleton Rd., E.10.
6SL	British Broadcasting Co., Cardiff.



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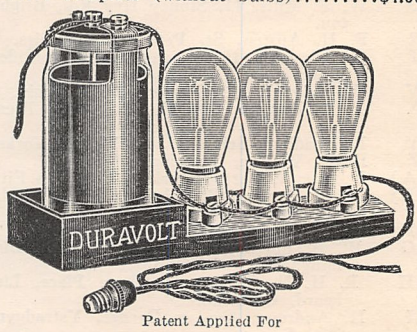

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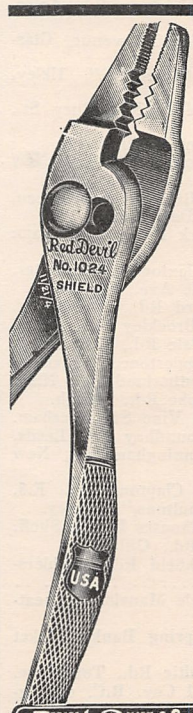

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A A 8 Fontana Carlos (h.)—Cochabamba 1212.
A A 9 Lopez de Espana Enrique—Pichincha 1031.
A B 1 Correa S. M.—Larrea 894.
A B 2 Bates Hector—Argerich 3343.
A B 3 Dubourg Ernesto—Cabildo 3556.
A B 4 Marti Mas Enrique—Lima 667.
A B 5 Bellocq Teodoro M.—Arenales 1307.
A B 6 Coll Plana Enrique—Rivadavia 4426.
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A F 9 Bertran Anibal—Quesada 2159.
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A G 3 Forcat Carlos—Rivadavia 2594.
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Operates a loud speaker.
Two tubes do the work of five.
Cuts battery cost 60 per cent.
Does not squeal or radiate.
Stations can be logged.
Amazing clarity and volume.

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I enclose 10 cents (U. S. stamps or coin) for copy of "Shamrock Radio Builders' Guide Book" containing diagrams and complete instructions for building 10 sets at prices ranging from $15 to $50, which instructions are so easy to understand and the sets so simple to build that ANYONE can build them in a few hours.

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Catch Everything in the Air!

Keep your radio batteries charged — and you won't miss a thing.

APCO Battery Charger does the trick over-night for less than 10c per battery. It's noiseless, clean, compact. Connects with ordinary light socket as easy as an electric "flat." Write for interesting circular and nearest dealer's name.

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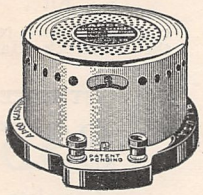

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Made of Phosphor Bronze and Sterling Silver. Perfect Conductor. No Corrosion. Prefect Reception. 100 ft. with insulators $3.00

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Made of Phosphor Bronze and Sterling Silver—sharpest tuning. Fits any room—shipped ready to install. Each $2.50

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Latest Discovery. Perfect Conductor. No Current loss. Easy to Solder. Shipped in 25 foot coils—no waste. Per Coil $1.25
Silver Neutralizing Condensers. Mounted. Metal Parts Silvered .....Each $1.25

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Charges any storage battery.
110 volts 60 cycles A.C.

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D C 4 Cabral Jose A.—Pinto 619, Tandil.
D C 5 Casino de oficiales, Colegio Militar—San Martin.
D C 6 Bellmann Enrique—Monroe 1733, Lanus.
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1 AB Penny, Victor Geo. Auckland—5 watts; 140 metres.
1 AQ Sommerville, Aymer Alexander, Thames—5 watts; 140 metres.
1 AO White Russel Garland, Auckland—5 watts; 140 metres.
1 AW Maxted, Robert, Thames—5 watts; 140 metres.
1 AI Goodwill, Charles Seivier, Hamilton—5 watts; 140 metres.
1 AZ Sherson, James Reginald, Hamilton—5 watts; 140 metres.
1 AV Bingham, John Merton, Auckland—50 watts; 180, 170, 160 metres.
1 AA Edwards, Cecil Norman, Auckland—10 watts; 180, 170, 160 metres.
1 AC Spackman, Leonard S., Auckland—5 watts; 140 metres.

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BEST SERVICE, HIGHEST QUALITY, LOWEST PRICES

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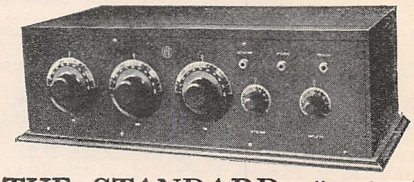

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THE BEST AND MOST POPULAR NEUTRODYNE IN THE WORLD WITH OUR UNCONDITIONAL GUARANTEE.

Every part is DESIGNED TO match, and the set is BALANCED TO PERFECTION.

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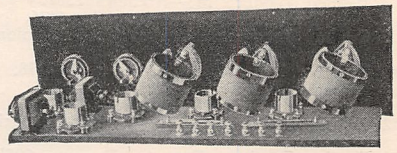
All parts to BUILD one like our STANDARD NEUTRODYNE $32.50, Cabinet extra

A & P 5-TUBE SET
SPECIAL
KNOCK-DOWN

Every part that is needed to build an A & P NEUTRODYNE is included in the kit at this remarkably low price.



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These parts are constructed in our factory according to NEUTRODYNE specifications, and are guaranted to be the BEST MONEY CAN BUY. Neutro coils have silk covered wire wound on genuine Bakelite. No shellac or varnish which introduce losses. Panel is drilled and engraved. Set of diagrams is included.

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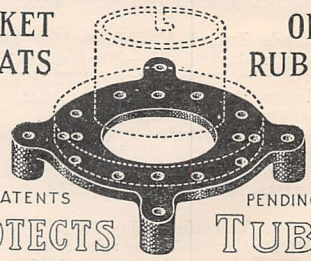

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Just the mounting for portable camp sets and Super-Heterodyne.

Price, 35c. Each—3 for $1.00, Post Paid
At your retail store. If your dealer doesn't have them, order direct.

ILLINOIS RADIO COMPANY
Springfield, Illinois

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1 AK Claxton, William Harry, Thames—5 watts; 140 metres.
2 AC O'Meara, Ivan Henry, Gisborne—50 watts; 175, 165, 155 metres.
2 AS Simpson, Albert Ed. Huia, Wellington—15 watts; 160, 170 metres.
2 AF Sinclair, Wm. John, Gisborne—50 watts; 175, 165, 150 metres.
2 AH Wanganui Amateur Wireless Club, Wanganui—50 watts; 175, 165, 155 metres.
2 AJ Bransgrove, Thos. Hy., Stratord—5 watts; 140 metres.
2 AM Buist, Dr. Wm. Fredk., Hawera—50 watts; 180, 170, 160 metres.
2 AO Brunette, Gordon Albert John, Opunake—5 watts; 140 metres.
2 AP Collier, Percy Chas., Wellington—5 watts; 140 metres.
2 AQ Coutts, Morton, Wm., Taihape—15 watts; 175, 165, 155 metres.
2 AI Harrison, Walter Leslie, Wellington—5 watts; 140 metres.
2 AE Patty, Robert James, Gisborne—5 watts; 140 metres.
2 AK Rowson, Leslie Hawera—5 watts; 140 metres.
2 AD Stevens, Percy Ronald, Gisborne—5 watts; 140 metres.
2 AB Wilkinson, Dan, Motueka—5 watts; 140 metres.
2 AL Edwards, Walter Geo, Shannon—5 watts; 140 metres.
2 AW Clarke, Cecil Roy, Wellington—5 watts; 140 metres.
2 BI Shrimpton, Harry Neville, Nelson—5 watts; 140 metres.
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2 AR Clarkson, Thos, Reynolds, Hastings—5 watts; 140 metres.
3 AH Courtis, Henry Bural, Timaru—5 watts; 140 metres.
3 Ak Reynolds, Ernest, Ashburton—5 watts; 140 metres.
3 AM Withers, Bernard Tyndall, Christchurch—5 watts; 140 metres.
3 AL Dawson, Wilfred Milne, Ashburton—5 watts; 140 metres.
3 AS Paterson, Ian James McLean, Timaru—5 watts; 140 metres.
3 AF Ball, Leonard Francis, Sydenham, Christchurch—5 watts; 140 metres.
3 AD Blake, Robert Geo. Fredk., Greymouth—5 watts; 140 metres.
3 AC Radio Society of Christchurch (Inc.), Christchurch, 15 watts; 300, 175, 155 metres.
3 AB Vincent, Francis, Christchurch—20 watts; 175 and 155 metres.
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3 AL Dawson, Wilfred Milne, Ashburton—5 watts; 155, 165, 175 metres.
3 AQ Smail, James Ingram, Christchurch—15 watts; 160, 170, 180 metres.
4 AH Macdonald, Ian Sinclair, Dunedin—5 watts; 150 metres.
4 AJ MacGorge, Claude Norman Douglas, Dunedin—5 watts, 150 metres.
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4 AG Slade, Ralph, Dunedin—3-5 watts; 140 metres.
4 AM Crockett, Wm. McGill, Dunedin—3-5 watts; 140 metres.
4 AK Shiel, Wm. Labor, Dunedin—5 watts; 140 metres.
4 AO Scott, Thos. Edward, Dunedin—5 watts; 140 metres.
4 AA Bell, Frank Dillon, Waihemo—50 watts; 171, 161, 151 metres.
4 AD Jordan, Arthur Edward Invercargill—50 watts; 175, 165, 155 metres.
4 AB Otago Radio Association, Inc., Dunedin—(Transmitting apparatus dismantled 17/8/23) 50 watts; 300 and 160 metres.
4 AP Invercargill Radio Club, Invercargill—15 watts; 160, 170, 180 metres.
4 AC Robinson, Robert Edward, Dunedin—50 watts; 175, 165, 155 metres.
2 FC Farmers, Ltd., Sydney—1100 metres.
2 BL Broadcasters, Ltd., Sydney—350 metres.

Vacuum Tubes and Earthquakes

(*Continued from page* 662)

The vacuum tube seismometer might profitably be employed in warfare for determining the location of big guns. When heavy guns are fired they start an earth wave similar to seismic disturbance, and this wave

Save on your Radio Table by buying direct —*from the factory*

SEIZE this opportunity to buy a high grade radio table at a big saving. Strongly made of the best materials, and beautifully finished. They'll set off your receiver, and provide an enduring piece of furniture for your home. Just check the table and finish you want in the coupon below—and we'll do the rest.

$22
Direct from factory

$22 from the factory

RADIO Table No. 81 shows the utmost refinement of line, design and workmanship. It will blend with the most exacting home environment. Cabinet contains space for "A" and "B" storage batteries, hook for headphones and magazine rack. Four insulated holes are provided at the rear for lead-in wires. Top measures 36 x 20 inches. Supports weight of over 200 pounds. Offers choice of Plain Solid Oak, Hardwood (birch) in Mahogany or Walnut Finish.

$10.50 direct to you

RADIO Table No. 82 combines exceptional strength, durability and handsome appearance. May be had in Solid Oak or Imitation Mahogany. There is one roomy drawer, and a strong shelf for batteries. Top 20 x 30 inches.

$10.50
Direct to you

OAK
$7
From the factory

A REMARKABLY substantial, handsomely finished piece of furniture (Radio Table No. 29). Can be furnished in Golden or Fumed Oak or Imitation. Complete with one long drawer and handy shelf for batteries. Durably made to stand great strain.

SALISBURY BROS. FURNITURE CO.
Randolph, Vermont

Salisbury Radio Tables

SALISBURY BROS. FURNITURE CO., Dept. A-2, Randolph, Vermont.

Send the Salisbury Radio Table which I have checked and indicated finish wanted.

No. 81 ($22) finished in .....
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I will pay the expressman $..... plus expressage on delivery.

Name.....

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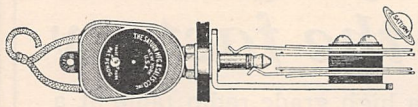
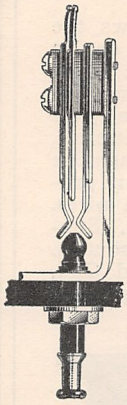
For Better Connections



Good connections are worth making sure that you get the best possible plugs, jacks and switches. Examine the SATURN Products at your dealers. Their neat, clean-cut appearance and exclusive features give you the most value for your money.



The NEW SATURN Improved Automatic Plug

Ready to use as soon as you buy it. Just slip the phone cord tips into the *Plugs*. Instantly gripped—the harder you pull, the firmer the grip—yet immediately released by a light touch on the small lug. No tools necessary. Neat, polished Bakelite housing—no exposed metal. NEW Reduced price—$.75.

SATURN Perfect Jacks

Easy soldering terminals with crowfoot offset, tinned with non-corrosive solder flux compound.

Rounded corner brass brackets, nickel plated.

German silver blades with sterling silver contact points.

The SATURN "Perfect" BatterySwitch

Push-pull action—smooth as velvet, yet absolutely positive. Fits any panel. Made the same "quality way" as other SATURN products.

List price ....$.75

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Write for Our New Circular

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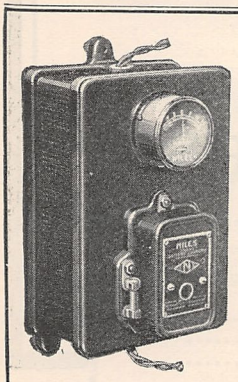


The Niles Battery Charger

Charges 6 volt automobile batteries, or Radio A Batteries, and 1 to 4 B Batteries. Charging rate on 6 volt batteries, 8 to 10 amperes.

Is of the double vibrator type, using both sides of the alternating wave. Results: increased efficiency, durability, and low operating cost.

The Niles Charger gives the permanent satisfaction you expect when purchasing a battery charger.

Write for catalog.
Model A $19.00
Model AB $21.00

NILES MANUFACTURING COMPANY
Dept. X, Ypsilanti, Mich.

WALNART
"TROUBLE-PROOF"
RADIO PRODUCTS

may be detected and measured by means of the vacuum tube seismometer at a considerable distance away. Two such seismometers would be required to definitely locate a gun. Each instrument would determine the line connecting it with the gun, and the intersection of these lines would be the location of the gun.

How the Navy Radio Helped the World Flyers

(*Continued from page 664*)

search. And through the whole work the inevitable press dispatches had to be sent out nightly to Estavan. The world was interested and dependent on Coast Guard Cutters for news. The *Haida* on this press work used her half kilowatt spark set and successfully worked Estavan at a distance of fifteen hundred miles.

With the search progressing slowly and no news to point to the safety of the plane and its occupants, the three planes at Unalaska decided to continue their flight. The *Haida* with Major Blair proceeded to Atka. The planes hopped off and made Atka. The *Eider* proceeded to Attu. The *Haida* was withdrawn from the search and went to Atka. The *Algonquin* remained at Chignik to continue the search. Thus the entire work of the flight through the Aleutians devolved upon the *Haida* and *Eider*.

In order to properly understand this work it is necessary to outline the radio equipment of the participants.

The radio equipment of the *Haida* is the same as when she was originally commissioned. The main transmitting set consists of a two kilowatt arc. The arc has proved extremely satisfactory on high wave-lengths. When used with the chopper on low wavelengths results have not been noteworthy. This type of set for a cruising cutter on Coast Guard duty is not desirable, in as much as most of the messages sent are of few words. For the flight work, especially press, the set came through splendidly.

The auxiliary transmitting set is a half kilowatt spark. We secure ten amperes radiation on this set. The spark set has been used as the main transmitting set practically ever since the vessel has been in commission due to difficulties with the arc on the lower wave-lengths.

The radio telephone is a Western Electric transmitter-receiver type CW 938-A with amplifier type CW 926-A. This telephone was formerly on the *Bothwell*.

The main receiver of the *Haida* is an SE 1420 C model and the amplifier is a model SE-1008.

The antenna of the *Haida* is largely responsible for the results on the flight work. The aerial is as originally installed. Insulation has been carefully watched. Trouble usually arises from leakage at the lead-in insulator when the arc is in use. This trouble has been eliminated by giving the insulator an occasional paraffin bath.

OTHER EQUIPMENT

The *Eider* has a half kilowatt spark transmitting set. Her radiation is about four amperes and her transmitting radius is stretched when she sends four hundred miles. She can transmit only on five hundred kilocycles. Her Captain would not permit the *Haida* to endeavor to tune the set to a different frequency. We could have done so by using our receiver as a wavemeter in the absence of a regular instrument.

The receiver of the *Eider* is an old Navy type. Her aerial defies description. It is as unique as it is inefficient. It runs through stays and around masts. The insulation is leaky.

UNITY $1.50
Electric Soldering Iron
Guaranteed!

100 HOURS of continuous service have failed to overheat the new Unity Electric Soldering Iron. It's built on the same principle as a flat-iron. Heating element (in tip—not behind it) is air-tight compressed—can't burn out. Light weight, well balanced, specially designed for difficult intricate wiring.

And just look at the Price!

UNITY VERNIER RHEOSTAT
with switch

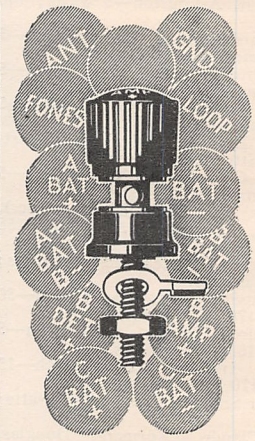
THE only continuous-wire vernier rheostat — unique cut-out switch permits tube being turned on or off at any point without changing adjustment. **All resistances $2.00**

Write for FREE BOOKLET
On "Tube Control" prepared by J. E. Jenkins, engineer station W. G. N. Shows what proper **tube control** means to the selectivity and quality of a receiving set.

UNITY MFG. CO., 224 N. Halsted St., CHICAGO
New York Office, C. M. HUNT, 50 Church St.

UNITY
Vernier Rheostat

Establishing a New Standard!



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"Read'Em" Binding Posts
"The Knobs Can't Come Off"

NEW MARKINGS FULFILL EVERY DEMAND

The Utmost in Quality at
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At Your Dealers or Sent Postpaid.

The Marshall-Gerken Co.
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$3 DOWN Brings you a Genuine UNDERWOOD TYPEWRITER

10 DAYS FREE TRIAL Your $3.00 unconditionally returned if at end of 10 days you are not satisfied with this late model UNDERWOOD typewriter rebuilt by the famous Shipman Ward process.

GREAT PRICE SAVING Direct to you from the largest typewriter factory in the world by our money saving methods.

EASY MONTHLY PAYMENTS So small that you will not notice it while you enjoy the use of this wonderful machine.

FREE BOOK OF FACTS Explaining Shipman Ward's wonderful system of rebuilding typewriters and also valuable information about the typewriter industry both instructive and entertaining.

Act Today! Mail Coupon

5 Year Guarantee

Shipman Ward Mfg. Company
1958 Shipman Building
Montrose & Ravenswood Aves., Chicago

Please send me a copy of your free book of facts, explaining bargain offer.

Name.....
St. and No.....
City..... State.....

For power the *Eider* has one set of storage batteries. They must be constantly on charge when the ship is not transmitting. She carries one radio operator, a Chinaman, of limited abilities. Her engineer officer takes a watch at times when he is off duty.

In general it may be said that the *Eider* has a radio set in a very poor condition. What the vessel accomplished in connection with the flight radio work is greatly to the credit of her Captain, who is cognizant of the limitations of the ship's apparatus.

The third set in use to the westward was the shore station at Atka. When the *Haida* reached Atka we found an old radio set which the *Algonquin* installed some years ago for the Bureau of Education. The set was more or less of a wreck. The Edison batteries had been exposed and almost ruined. The power plant was a hopeless wreck, due to the fact that some enterprising native had used it as a chicken coop. Water had leaked in and damaged the receiver. The antenna was being used by the Aleuts as a rack for drying fish and as a clothes line.

The *Haida* charged and cleaned the batteries, sent a spark coil ashore for use as a transmitter, fixed up the receiver, cleared fish and clothes off the antenna, installed new insulation, and, in other words, placed the station in operation. For an operator we used one of the school teachers who knew Morse Continental code and all messages between the *Haida* and the shore station were sent in that code.

The shore station at Attu is a matter of pride with the *Haida*. Early in March the ship started to find out about the establishment of a shore station. Such a station would be valuable in that it would eliminate the necessity for one of the assisting vessels remaining at Attu until the flight should leave. The ships could be well out along the course of the flight and the shore station could give notice when the planes hopped off. Matters were slow in progressing and action in favor of the station was not taken until the afternoon before the *Haida* sailed from Seattle. The Signal Corps had no portable sets at Seattle. The Air Service then gave the ship permission to purchase the parts and power for a shore station capable of sending and receiving messages at a distance of two hundred miles. We decided on a twenty watt tube set. We did succeed in securing a Signal Corps receiver and amplifier of very good quality.

The transmitting set was built by the *Haida* en route north. It consisted of four five-watt tubes in parallel.

For an antenna we constructed a squirrel-cage, six wire affair, about sixty feet long. We figured in case of necessity that we had enough battery power to maintain the station continuously for forty-eight hours. We used thirty-six hours as the safety margin. We found that with the available power we secured best results using two tubes, rather than four. We also had an auxiliary transmitter consisting of spark coil operated by dry cells.

The station filled all requirements. We heard the spark coil at 60 miles distance. We worked the station constantly at 150 miles and the tube signals came in strong. The Dutch Harbor Naval Radio Station reported it heard strong signals from the shore station. The distance in this case was 900 miles. The station heard Cordova and Bremerton working and also heard the *Haida* working San Francisco.

This station was given the call letters NIFT2. H. D. Lane, radioman, first class, was the operator in charge.

These descriptions cover the apparatus to some extent. And so, proceeding with the work of the flight from Atka.

WEATHER REPORTS

The weather information from the *Eider*

THE EXECUTIVE

Every executive is at some time called upon to make decisions which involve applied Chemistry. If he does not know Chemistry, he must rely entirely upon his factory chemists or high priced consultants. A knowledge of Chemistry, easily gained through our Course, would strengthen your position greatly and save you thousands of dollars.

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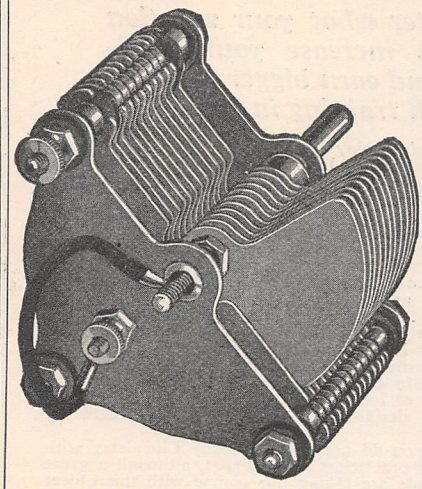

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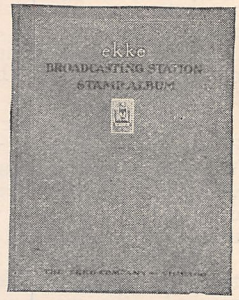
was the most important radio work the *Haida* carried on in that it had to do directly with the progress of the flight. Due to the difficulties of communication with the *Eider* and the possible chance of the flyers being without reliable weather information, the *Haida* established a supplementary weather service. This was accomplished by getting in communication with all trans-Pacific ships on the great circle route. The route comes north and nearly touches the Aleutians. We were receiving hourly weather reports from six vessels of varying nationalities. The co-operation and interest of these foreign vessels made this factor of the work very agreeable. The vessels did all possible to assist the *Haida* in working the *Eider* but were not of material assistance as relay vessels.

The *Haida* was intercepting messages passing through Cordova Naval Radio in order to get the messages from Washington without delay. In a number of cases by using this method of listening in we were able to give messages from the Chief of Air Service to the Flight Commander twenty-four hours before they came through regular communication channels. This undoubtedly saved much delay in the progress of the flight. We were routing daily traffic through St. Paul and Dutch Harbor to the Chief of Air Service and the Commander Bering Sea Patrol Force.

During the three days at Atka the *Haida* received and transmitted more than fifty radiograms of more than thirty words each. The great majority of these were handled on the half kilowatt set. Many press messages ran into hundreds of words. The little half kilowatt set was going strong. Only careful operation and extreme precautions prevented a breakdown in the insulation of the set. The dream of a good big two kilowatt spark set was constantly in mind. One laconic reply to us stands out in memory of this time. We were working the *Pope* on the spark set and were using 500 kilocycles. We asked her to shift to some other frequency, preferably 375 kilocycles. She replied that on 375 kilocycles she only radiated twenty-three amperes while on 500 she only radiated thirty-three. She then added that she was using a five kilowatt spark set and asked about our set. Her



Have you your EKKO Broadcasting Station Stamp Album?

Here's what every radio fan has wanted—a convenient, permanent and authentic means of recording all the stations you hear over your set. The Ekko Album contains spaces for a beautifully engraved stamp from each of more than 650 stations. These stamps are verified and prove your reception of the station.

Proof of Reception cards are furnished with the album. You send the card to the station, together with ten cents, to cover cost of verification, giving facts which prove to the station you have heard their broadcasting. In return the station sends you their verified stamp as evidence of actual reception. The stamps are beautifully engraved in different colors and there is an individual stamp for every station showing the station call letters.

The album is 9½ x 11 inches, handsomely bound in a two color cover. It contains 96 pages, with spaces for stamps of all recognized stations in the U. S. and Canada, arranged alphabetically by states and call letters. It also contains an alphabetical list of the official names and other interesting features of stations, as well as a convenient log.

See your dealer today and get a copy of the Ekko Album and **start a collection of these stamps.** You will find this a new and fascinating method of verifying the stations you hear. If your dealer cannot supply you, sent direct on receipt of price. Money back if not satisfied.

Price $1.75

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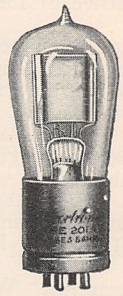

Type 201A operates as either Detector or Amplifier on ¼ amp. filament consumption. The Ideal Tubes for Neutrodyne and Super-Heterodyne. Type Detector 12 1½ volt.

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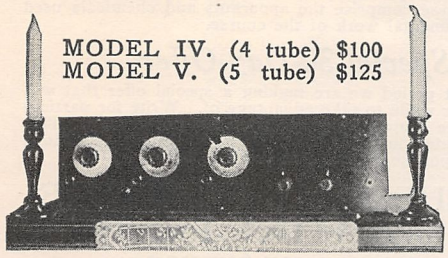

BILTMORE MASTER REFLEX

Sensitivity:—Five stages of radio frequency amplification, detector, and two stages of audio frequency amplification in Model V, and four stages of R.F., detector, and 2 of A.F. in Model IV, make the BILTMORE MASTER REFLEX receivers ultra sensitive. In this respect, they are surpassed by no standard receiver. Both models have many times given good transcontinental loudspeaker reception, using only an indoor antenna! The BILTMORE operates the loudspeaker on stations heard only on the phones with other receivers.

Tone:—A fixed crystal detector and perfect design are responsible for the wonderful quality of reception on the BILTMORE. There is no howling and squealing to mar the enjoyment of a program.

Selectivity:—In both models, two of the stages of radio frequency amplification are tuned. The very best low loss condensers and low loss tuned R.F. transformers are used, resulting in an unsurpassed selectivity—sufficient to tune out the worst local interference, when one wishes to listen to a distant station.

Appearance:—A Radion Mahoganite panel, nickel plated metal parts, white and mahogany dials, and a heavy hand rubbed mahogany cabinet give the receiver a wonderfully beautiful appearance.

Apparatus:—The receiver is made from the very best apparatus which we can obtain: Radion panel, Federal jacks, Dubilier Micadons, Fada rheostats, American Brand 100 to 1 vernier condensers, and Acme radio and audio frequency transformers.

Operation:—The operation of the receiver is simplicity itself. The three dials have the same setting for any one station, which setting is always the same for that station. Consequently, when the approximate dial setting for any one wavelength is known, it is a matter of a few seconds to select any desired station within range, provided that that station is in operation. All connections are made permanently to the rear of the cabinet, and the snapping of a switch prepares the receiver for reception. The only antenna requirement is a short indoor wire and a ground.

Write today for literature on both models of this wonderful receiver.

If your dealer is not yet supplied, send us his name.

The Biltmore Radio Company Dept. N, Boston 30, Mass.

answer when we told her that we were using a half kilowatt set radiating ten amperes was vivid and descriptive.

The news of the planes leaving Atka was flashed by the *Haida* to San Francisco within ten minutes of the official time of departure.

We also brodacast the information on 500 kilocycles spark and on 125 kilocycles arc. Immediate acknowledgments to the broadcast were received from the *Eider,* Dutch Harbor, St. Paul, St. George, Kodiak, *SS. President Jefferson, SS. Achilles, SS. Empress of Russia,* and numerous other trans-Pacific vessels. Thus the news was flashed all over the Pacific and the world that the U. S. Coast Guard Cutter *Haida,* on duty with Around World Flight announced.

The *Haida* next proceeded to Attu. Upon reaching there we looked the *Eider's* set over and tried to get her to let us calibrate it to some other frequency than 500 kilocycles. The *Eider* proceeded out to the westward to report the weather conditions on the course of the flight.

MUCH WORK

We set up the shore station and tested it out quite thoroughly due to the fact that rough weather caused us to run considerable distance off shore. About this time a new factor came into the radio game when we started our schedule with the *U.S.S. Ford* at Paramushiru, Kuril Islands, Japan. The *Ford* sent weather quite frequently and in addition we relayed a great deal of her traffic to and from St. Paul.

An interesting development took place while the *Haida* was working the *Eider.* The length of the messages had caused us to run overtime into the *Ford's* schedule. The *Ford* heard us in the air and called the *Haida.* She then must have mistaken one of our "go ahead" signals to the *Eider* for a signal to her. At any rate the *Ford* opened up and sent her message. It happened that two operators were listening in on the *Haida* and the result was that we got the *Eider's* message and the *Ford's* at the same time.

Operations to the westward would not be complete without a reference to Japanese code, or "Katakanas." The *Eider* was sending on 500 kilocycles. All the "J" ships in the ocean seemed to be sending in Japanese code on the same frequency. The nearer to the Japanese coast we went the greater this difficulty became. Japanese ships do not seem to understand the meaning of QRX. They usually turn on more power when they receive the signal. One system we used at this time was to ask them to copy for us. They very courteously did so and then all tried to give the messages to the *Haida* at one time.

While at Attu, the *Haida* was assisted materially by the Dutch East Indian Weather Observing Ship *Tjikandi* (PLW). Her weather information was excellent and willingly given. We worked her several times with radio telephone and secured fine results at 250 miles.

When the planes reached the Kuril Islands we turned them over to the destroyers of the Asiatic Fleet. At this time we received numerous commendations for the work accomplished. One of the most characteristic follow:

To Shore Radio Station Attu (NIFT2) VITAL MESSAGES REFERENCE WEATHER AND DEPARTURE OF FLIGHT CAME THROUGH FROM SHORE STATION PROMPTLY STOP YOUR JOB WELL HANDLED STOP ACCEPT MY CONGRATULATIONS.
BISSELL.

One of the finest features of the work with the World Flight is evidenced in the fact that when the ship was placed in a responsible position she "delivered the goods." Coast Guard Communication is on

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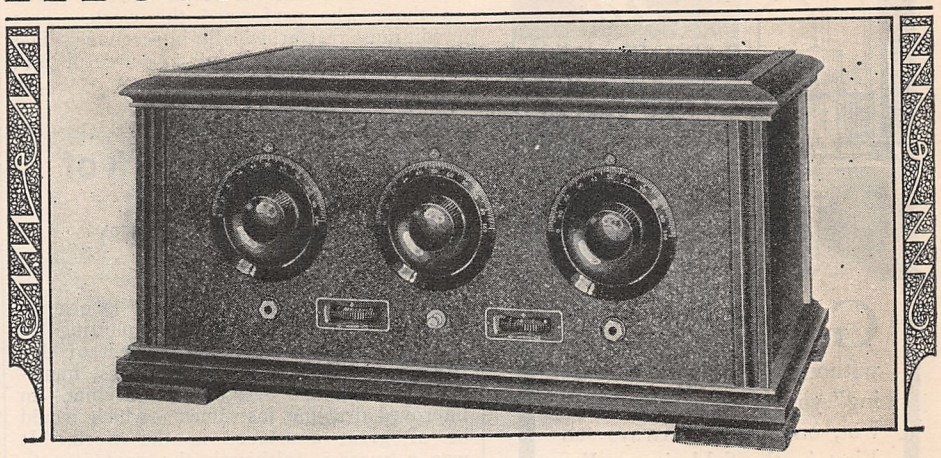
ELECTRICAL EQUIPMENT



The Measure *of* True Worth

SPECIFICATIONS

Circuit: Two stages of tuned radio frequency amplification, detector and two stages of audio frequency amplification. Non-oscillating.

Tubes: Five in all. Jacks provided for either five or four tube operation.

Batteries: Either storage or dry-cells.

Cables: Complete set supplied for "A" and "B" batteries.

Wave lengths: 200 to 600 meters, with uniform efficiency of reception.

Aerial: 75 to 125 feet, single wire.

Panel: Aluminum, with attractive crystal black finish. A perfect body capacity shield.

Dials: Sunken design. Shaped to fit the hand and permit a natural position in tuning.

Rheostats: Adequate resistance for all standard base commercial tubes.

Condensers: Single bearing, low leakage losses.

Sockets: Suspended on cushion springs which absorb vibrations.

Cabinet: Mahogany, with distinctive lines and high finish. Ample space provided for "B" batteries.

EFFICIENT performance, attractive appearance and moderate price are the three basic elements that comprise value in a receiving set, as in any other article. Trick names and catch phrases, used to designate circuits, mean little and often confuse the buyer.

All three essentials are combined in the Type 6-D Receiver.

Performance: Extraordinary selectivity widens the choice of programs. In close proximity to powerful stations, the sharpness of tuning is marked. Far distant points are received with unusual clarity and volume. Tuning is very simple. The three dials are closely matched at all wave lengths, and settings are easily memorized.

Appearance: The substantial mahogany cabinet, with distinctive lines and high finish, is a fitting addition to the living room or library. The symmetrical panel layout and interior construction bear the imprint of advanced thought and skilled workmanship.

Price: $125.00, without tubes and batteries, creates a new standard of value.

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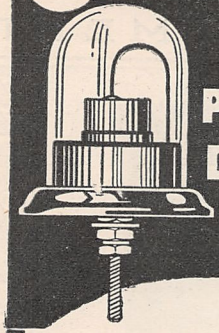

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the average not difficult radio work. Our distances are usually short and our power is ample for the distance in most cases. This is a case of operation where the distances were unreasonably long and the equipment not up to the necessary standard. It must be assumed then that it is a case of good operation and that the credit must be given to those who performed the work. This credit must rest principally in receiving. The results were obtained by resourceful and energetic operators.

The Life and Work of Lee De Forest

(*Continued from page* 659)

His work in the psychological laboratory had to do, chiefly, with the plotting of curves from data. A great amount of this work was to be done and DeForest immediately set about designing a machine—an improved drawing instrument—which would be of great assistance in the work. It was a success (although the professor to whom he showed it frowned on the idea and prohibited its use for some time).

Aside from these inventions completed he was working on a method for increasing the efficiency of steam engines. (He continually had four or five such problems in mind upon which he worked or thought when time presented itself.) This was a system for turning the steam at 100 degrees Centigrade back into the boiler feedwater, thus saving the heat of the exhaust steam. He designed the necessary apparatus, figured out the pressure and back-pressure and fully examined the mathematics involved. With this done he took the whole idea to a learned professor of the physics department for criticism. What followed:

"He (the Prof.)," DeForest wrote in his diary: "promptly produced the formula $\frac{W}{E} = \frac{T_1 - T}{T_1}$ and clung to this stronghold, acting like a blockhead. I wasn't talking about the engine but about the boiler. And he knew only of one engine, the condensing!

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DURHAM Fixed or Variable Resistance Units (grid leaks) fit standard holders. But you will find the new style base more convenient. Three styles take care of plain mounting, grid leak and condenser mounting and double base for resistance amplifiers.

PRICES:—
Fixed, 28 sizes 50c - 75c
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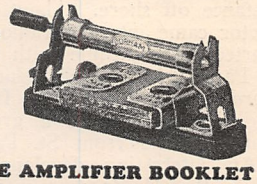

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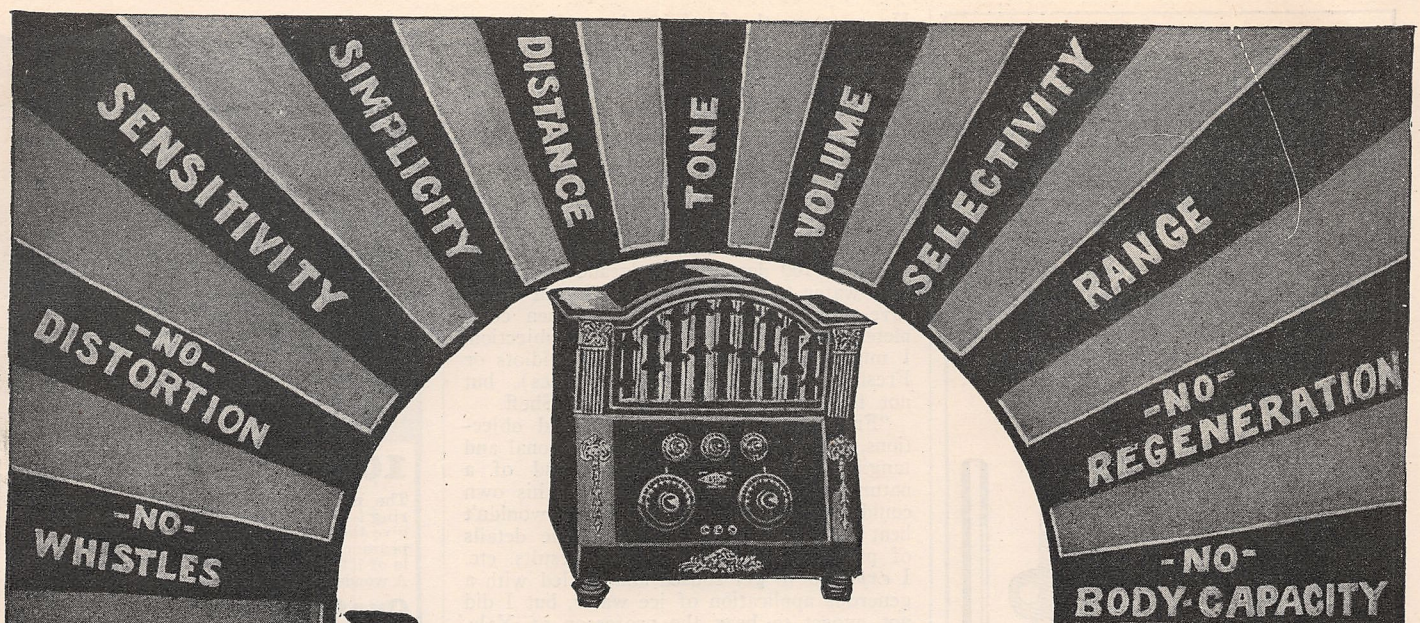

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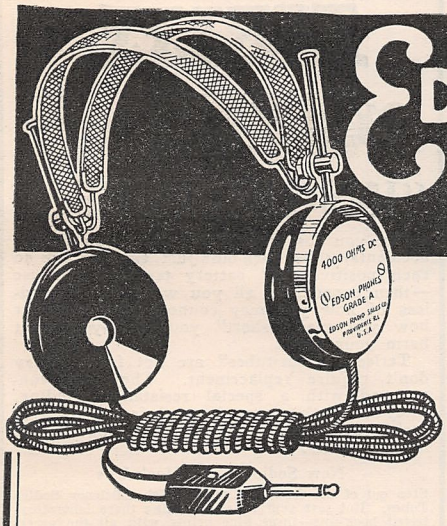

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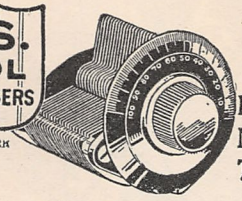

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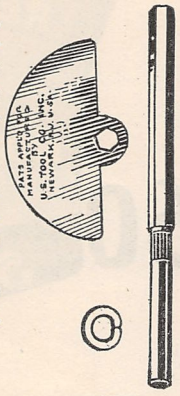

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He so earnestly fixed his learned gaze on formulae and antiquated physics that he doesn't know enough practically to be aware that engineers seek to get as hot water as possible. He would not admit that no non-condensing engine utilizes the heat energy in the steam after it had cooled to 100 degrees C., nor would he admit that if I could save this waste energy in the feed water I. would gain anything! Blind.

"Nor would he admit if you could get steam at 100 degrees Centigrade instead of cold water to put in your boiler you would save aught in fuel!! I was taken completely aback by this unexpected objection. I might have looked for it from idiots or Freshmen (no, only from lunatics), but not from a physics professor at Sheff.

"From him, indeed, I anticipated objections, but they were of a more rational and tangible order, more practical and of a nature such that other minds than his own could grasp them,—that the steam wouldn't heat fast enough or look into the details of pressure and back pressure, results, etc. I *expected* to get soused and chilled with a generous application of ice water, but I did not expect to hear the professor of Yale, as he stolidly grasped a simple formula, totally foreign to the case, declare that he would not look at the part I was speaking of or at anything else than his precocious formula and deny up and down that energy is wasted in exhausted steam! No wonder the natural philosophies of the last generation, out of which he never got his nose, describe specifically the primeval model of Watt's condensing engine. Of all the impractical, stupid arguments I have ever imagined a book-learned savant could show an inventor, this first experience of mine with one far exceeded my imagination. This was cold water indeed, but its frigidity was of so manifestedly a mistaken nature that it possessed little chilling qualities. I soon arose to the surface with increased faith in my machine and magnified contempt for the entirely theoretical man.

"Wise physicists and savants with their formulae may prove a thing absolutely impossible or physically impractical but the simple inventor dries their cold water with a towel of ingenuity and sponge of dauntless perseverance accomplishing their impossibilities."

This first year of facing the problems of invention taught DeForest two lessons which served him well.

Experience, like knowledge, has value only in application. Experience first teaches and then teaches avoidance. DeForest seemed to know, instinctively, the value of his defeat. His decision to discount the dicta of the thoroughly academic man was no mere phrase turning. Once privy to the actual value of their opinions he committed himself to them accordingly.

Another trait which worked much in his favor was inherited from his forefathers. It was the dogged tenacity, extreme belief in his own work. Work, he knew, accomplished almost everything.

This idea he carried over into his recreation. He was a rugged worker and a player of like fashion. Sport for him was indeed red-blooded. Taking no part in the regular constituted athletics of the school because of his meagre time, most of his enthusiasm was worked off in celebration of the victories of others. Upon the successful termination of an intercollegiate game there was a truly great demonstration. The team was usually feasted while the students made merry after their own fashion. The accepted custom was the firing of a pyrotechnic display, the retention of an itinerant German street band, a huge bon fire and a Gargantuan helping of horseplay as a garnishment. The horseplay was DeForest's own field. As everywhere else, he excelled. He wasn't even challenged.

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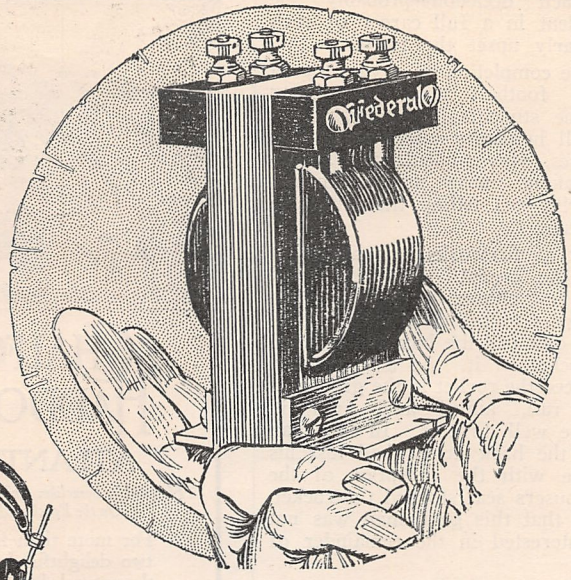

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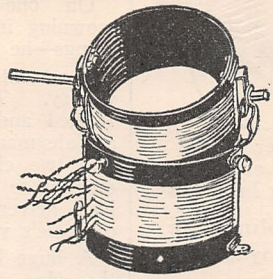

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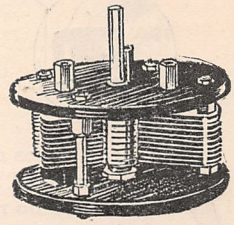

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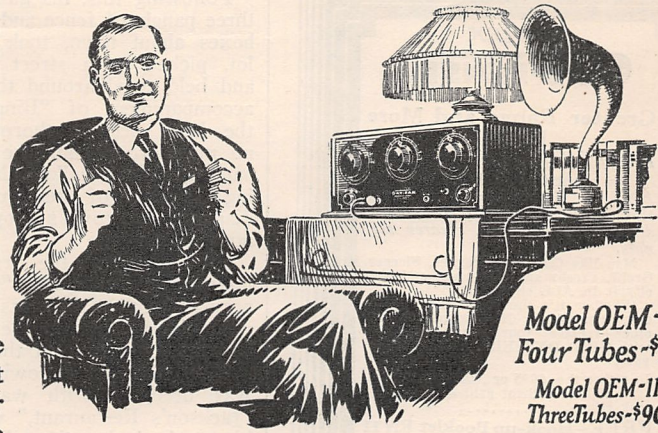

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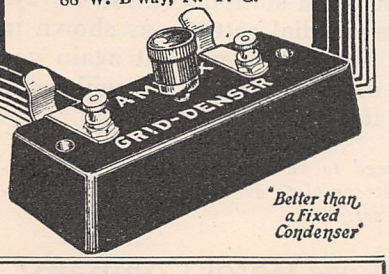

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On one such occasion—probably the crowning incident in a full career of such doings—he nearly upset the town.

It was at the completion of a very signal victory. The football team was being feasted and the students and muckers (to a Yale man all humanity was then divided into two classes, viz., students and muckers) were making merry around an old hack driver who was telling the multitude of Yale's virtues.

A huge box of fireworks was sitting at the edge of the crowd. DeForest, with the help of a few chosen companions—men of fitting prowess to associate with him in such exploits—obtained the box and selected the largest rocket in it. At a convenient distance he placed the rocket in the groove of a street-car rail, aimed and fired it. It proved to be well directed. In less than three seconds the hack driver had lost his entire audience with the exception of the man whose trousers seat stopped the rocket, and it is said that this gentleman was not particularly interested in the remainder of the discourse.

After enjoying the dumb show made by the fellow of the trousers seat in putting out the fire in his hip pocket they adjourned to other battle scenes. Their next stop was the theater.

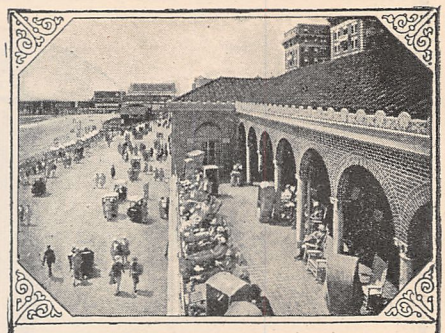
Selecting a seat in the midst of a row of dignified old ladies and prosperous looking men, DeForest, when the moment offered, began, stentorian voice, the 'Varsity yell. Other students instantly picked it up. There was a large bunch of them directly in front of him—he picked a seat behind them purposely—and they shouted lustily. The management forced the ushers and the janitor into police service and ejected the intruders only after the show on the stage had been completely stopped. On account of his position among the dignified and prosperous, he was the only student in the immediate vicinity who was not ejected. He had provided for this emergency when he selected the seat.

Following this, his gang gathered two or three panels of fence and all the loose goods boxes about town, took them to a vacant lot, picked up a street band on the way, and held revel around the open fire to the accompaniment of "Bingo Farm." When the band became thoroughly winded and no more wood could be found, DeForest's band of rioters walked about the street singing the sagas of their gods of gridiron and diamond, the town's people to the contrary notwithstanding.

By the end of the first year he had obtained the sobriquet, "the homeliest and nerviest man in the class." The title stayed with him throughout the years at Yale and he was so dubbed in the Year Book.

The summer following Freshman year was occupied with waiting on table at "Jackson's Restaurant," where he had taken his meals during the school term. He also continued his work at the psychological laboratory and his reading of electricity and the Life of Napoleon. He paid for his room rent that summer by mowing the lawn of Prof. Seymour, on Hillhouse Avenue. Under-nourishment and over-exertion during this first summer vacation at Yale lay the foundation for illness the following winter, from the effects of which he suffered for years after.

The second year brought a growth of his activities in the school as well as an increase in his outside scientific work. Shortly after Christmas, he was working upon the problems of a practical airplane, a double mirror illusion, and contemplating methods for the transmution of light and heat directly into electricity. He was also continuing his philosophical research, though his line of research did not follow the deeply metaphysical lines of the previous year. With the constant increase in companion-



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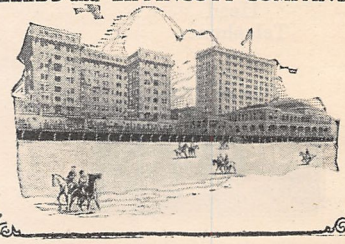

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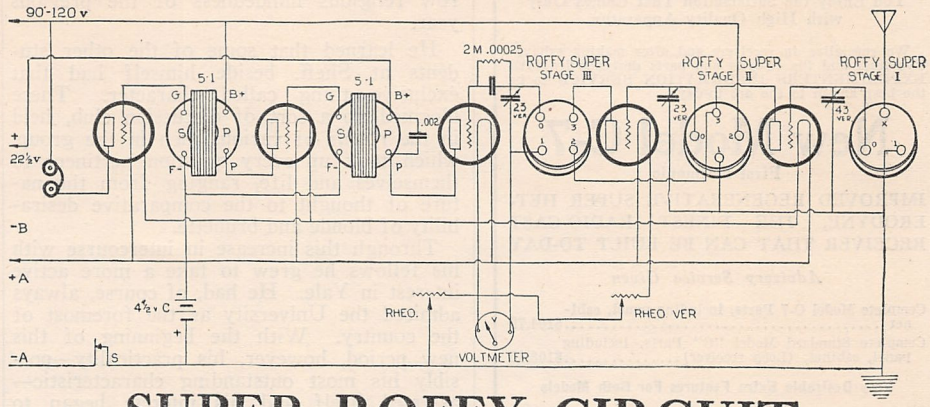

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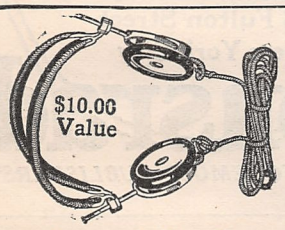

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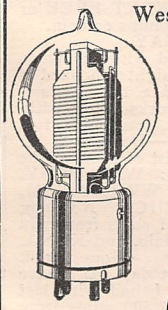

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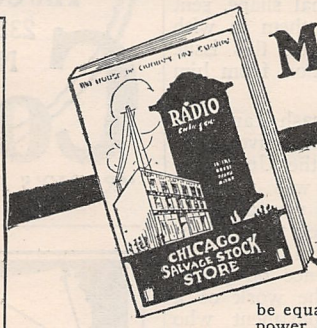

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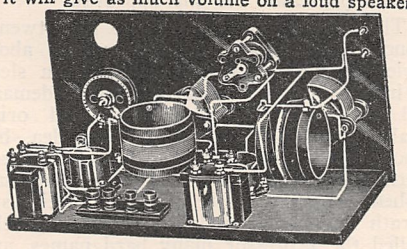

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ship, more human questions presented themselves for solution. Though his circle of friends was by no means large, he was nevertheless beginning to develop into a more natural and companionable fellow. With the companionship he began to lose some of the old detachment, the shyness and narrow religious mindedness of the previous year.

He learned that some of the other students at Sheff. beside himself had that exclusive thing called character. There bloomed up a sort of discussion club, held in the rooms of various men in the group, which took up every question pertinent to themselves and life, ranging from the nature of thought to the comparative desirability of blonde and brunette.

Through this increase in intercourse with his fellows he grew to take a more active interest in Yale. He had, of course, always admired the University as the foremost of the country. With the beginning of this new period, however, his practicality—possibly his most outstanding characteristic—asserted itself and his interest began to center itself in the life of himself and those around him.

The Yale *Scientific Monthly* had just been established and was the first to receive his attention. A prize contest was offered for the best scientific essay of the year and DeForest immediately began casting about for a subject. And he chose one in accordance with his law laid down after the Keuffel and Esser incident of the first year. He chose Aerial Navigation—certainly a subject in which there was ample room for "original and constructive thinking."

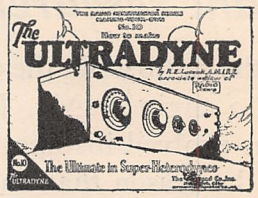
With the start of the essay, it was suggested that he try for a position on the editorial board. The idea struck him and he broadened his plans accordingly by preparing notes for the forthcoming issue of the monthly, which was just two weeks off. He whipped the notes into final shape, sent them to the editors and had them in with three days to spare. Following this issue each month found a contribution from him in the editor's basket.

As usual, his supply of cash ran low. The $300 per year scholarship given him from the DeForest Fund at the University was always spent before it was received, and his allowance from home was absurdly small. In dire straits he hoped to rehabilitate his supply of capital with this newly discovered ability to put science on paper. Accordingly, he learned of the work of a professor in the physics department who had just completed a new machine for intricate measurements, and upon investigation decided it was meat for a particularly saleable article. He began an intricate drawing of the machine and a long descriptive treatise. He completed it and submitted it to the professor for his approval.

The drawing consumed more than twenty concentrated hours and the writing about twice that much, hours filched from sleep as his class-room studies continued to demand all his time. The professor had originally given his consent for the idea, but upon seeing the completed article refused permission to DeForest until he had published something on it himself. DeForest's wrath knew no bounds. He cussed freely, called the professor many hard names, and put his manuscript and drawing tenderly away for further reference and use, if possible.

His ire arose even further when the professor, on a second request, refused even to allow the publication of the article in the Sheff. scientific monthly. It was upon this that DeForest had based his principal faith to election to the editorial board of the sheet. Upon the refusal, he saw his dream of the position and the money it would pay vanish gently from his grasp. Such was not the case, however, for he finally took

"ULTRA" Radio Reception



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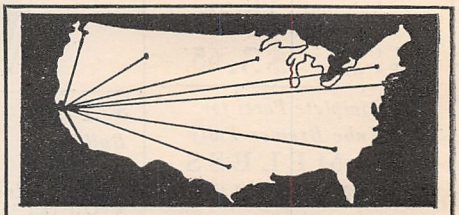

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EAST—Am more than pleased with the parts ordered from you. The first night I hooked it up and received Omaha. Since then Minneapolis and Los Angeles. It works better without amplification than most sets with two stages. —Donals, S. C.

WEST—I am sending you a list of some of the stations heard on one tube: WSB, WGY, KDKA every night. PWX, WWJ, WTAM, WLW every night. CFAC, CHCB. Not long ago I purchased another set of parts from you and first night got WGR, Buffalo, and KDKA. —Ione, Calif.

NORTH—Received coils OK today. If I have same results with these that I had with last will be wanting more. I am 1,500 miles from nearest station and have picked 56 to date. Chicago, Havana, Mobile, New Orleans and TWO IN ENGLAND.——Lunenburg, Canada.

Vesco Radio Shop BOX RN-117 OAKLAND, CALIF.

the bull by the horns and sent the banned article to the editors, who published it. He was elected on the strength of this article and of the voluminous notes he had published.

His new activity among the students and their organizations was not limited alone to science. He attempted the formation of a new club to be devoted to the more serious minded students—to those who had, through two years of college, shown themselves to be men of "character." Here, as ever, he was working for an ideal, although a more or less narrow one. The club was to be a compensating influence for the other secret organizations which he classified as "snobbish, money-worshipping groups working for their own group usually to the detriment of Yale and Sheff." He planned that this club, which was to be called the "Pipe and Cube," would at once be the most exclusive and democratizing influence in the school.

For the success of this venture he forewent a trip home at Christmas time only to have the last of the charter members, who had promised him to join, withdraw two weeks after the holidays.

He decided that they were all too conservative, afraid to break with custom. He said they were like all other conservatives, whom he characterized as "Adams who thought their own epoch was the millenium."

His constant study (he maintained his place among the first five of the class) and his continued eating at Jackson's with the great amount of outside work, brought him down in the spring of 1895 with typhoid fever. He was sent to the infirmary, where four weeks of convalescence were required to put him back at his work. The sickness was a direct result of too much work and mal-nutrition.

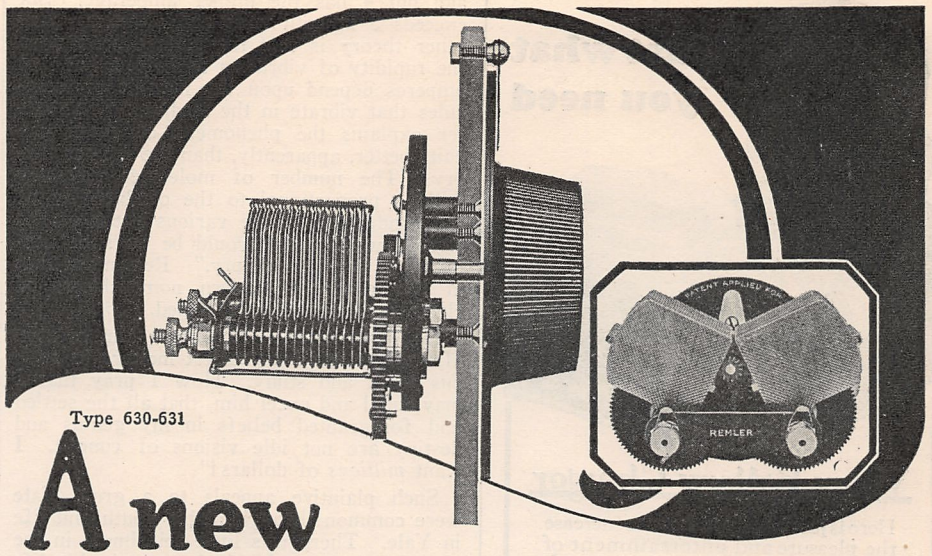
When he again resumed his regular activities he decreased his work, doing only his studies, the electricity reading and notes for the scientific journal. He completed the essay on Aerial Navigation and submitted it. The award was not made until the end of the term.

The summer following his second or Junior year at Sheff. was spent at a summer hotel on Block Island. Here the rough coarseness of his associates and his prejudices against their habits made the weeks exceptionally unpleasant. He did not like his working companions and his character would not admit his keeping it a secret. Tips, however, were fairly good and the work was not a great deal harder than he was accustomed to, so he felt compensated.

Labor Day brought his vacation to a fiting close. Of it he wrote: "I arose early, did not work. Saw the parade, ran to a fire, saw a dog fight, followed Primrose and West's minstrels and decided when changing clothes before dinner that bow ties and procrastination are the thieves of time."

With the beginning of his Senior year, he threw himself even stronger into his work than before. His studies consisted chiefly of engineering subjects. He took up in detail, the steam engine, stresses and strains, calculus, etc. He continued his work on electricity, going further into the subject. His chief text outside of his prescribed text books was a volume by Nicola Tesla. An idea as to the nature of his study may be found from examination of the sketches, in the illustration above and the explanation accompanying it:

"I hypothesize," he wrote, "that since the electric current is some form of wave motion its voltage depends upon the *rapidity* (the number of vibrations per unit of time) of its vibrations, while its quantity or amperage depends upon (or is) the *amplitude* of those vibrations. Thus 1 and 2 represent the waves of two currents of equal amperage but 2 has the higher voltage. Three and 4 have the same volt-



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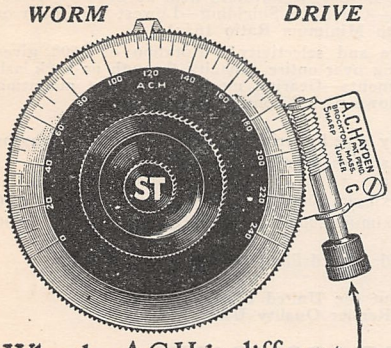

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age but 4 has the higher amperage. Six exceeds 5 in both volts and amperes. Another theory is that the volts depend upon the rapidity of vibration as before, but that amperes depend upon the number of molecules that vibrate in the medium. This latter explains the phenomena of shunt circuits better, apparently, than the former theory. The number of molecules vibrating will be proportional to the conductivity of the conductors of the various paths of the circuit, while there would be no such condition in the first theory." Remember that at this date the modern nomenclature of electrons had not been coined.

Of Tesla he said, "I admire him greatly. His works are the greatest incitors to zealous work and study. How I pray that I may equal and excel him, that all the settled and foregranted beliefs in my genius and destiny are not idle visions of conceit. I want *millions* of dollars!"

Such plaintive appeals to a great Fate were common throughout his youth and life in Yale. There was little selfishness in the plea for money. He had never in his life had enough for a decent existence. He even had to live in rooms without heat and study in them during the winter on account of lack of funds. Wealth, to him, was always a dream, therefore.

A great deal of his egotism was, largely, a shield for the weakness of his position. Having naturally great desires and being constantly thwarted he was driven to it. In moments, such as the one which forced the above statement, when he was brought face to face with success, the plaintive appeal for release from his poverty and careridden life always was evident.

As the year continued he was forced into more and more of the general activities of the school. He even paid good money to learn dancing! This wa. the result of many things. Chief among them, a pulchritudinous blonde second cousin in Boston whom he was on the verge of falling in love with and whom he invited to his Senior Prom. The lessons were devious, according to his accounts. And costly. Very. He had fully decided that his ideal must be a blonde. Why? He gave no reason.

One significant passage appears in his diary during this period, marking what was really the first turning of his thoughts towards things literary. It records his finding in the library of the prose tales of Poe, and the deep impression then made upon his mind by those weird tales of the grotesque and arabesque. Thereafter Poe seized upon DeForest's imagination. He read and re-read, mostly during vacation, all that Poe wrote, and sought for more. From his prose works he turned to Poe's poems. He memorized these, poem after poem, until by the time he left Yale he knew by heart most of the more notable ones.

This master of poetic description became a living ideal for DeForest. He found endless charm and spiritual uplift in these literary guilds. He found here, to his joy and surprise, a companion soul, a great creator of immortal beauty, one who, like himself, had lived apart, and had harkened to the heart-beat of nature—

"A wanderer of many-mantled well,
A dreamer in the moonlight, with his love."

And Poe opened to him visions of beauty and loveliness of expression which had for him hitherto not existed, and to which his soul responded to its utmost depths.

DeForest then found what until then was all unguessed, that in heart he too was a poet, although perforce a mute. Thereafter we find from time to time in his diaries attempts to give expression to the inspiration that momentarily sprang up within him. He had from boyhood been a true lover of Nature. A trip he had made when fourteen with his father one summer through Colo-

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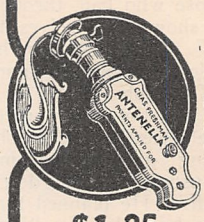

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rado had first opened his eyes to the grandeur and sublimity of Nature. He had fallen deeply in love with the beauty about New Haven, her stately, elm-roofed avenues, the charm of Lake Whitney and of East and West Rocks. But not until his studies of Poe's writings did he attempt to describe in pen-pictures the charm and beauty of such scenes. Thereafter more and more the pages of his diaries are given over to such recounting, until after 1900 but little else than pen pictures, prose poems, and poems in verse, appear. Through all these literary studies the influence of Poe is plainly evident; sometimes also that of Ruskin, Tennyson and Emerson, in whose works he delved deeply during the latter years of his post-graduate work at Yale. But of these things more, later on.

Among other things, he took time to start a regular crusade for the installation of the honor system in his class. As with a large number of his other ventures, he put a great amount of work into it without very much credit.

During the last half of senior year he took a strong delight in attacking, through his position as editorial writer on the scientific monthly, various affairs and conditions about the campus which did not please him. He brought a sharp tongue and convincing logic to the columns that demanded respect. When sufficient attention was not attracted in this manner he resorted to writing letters to the editor of the *Yale News*, the daily paper published by the University. It was through this medium that he launched the agitation for the honor system.

The final calamitous incident of his youth was the death of his father on January 27, 1896. He received a telegram two days before that the elder DeForest had fallen down the stairs at his home and suffered a stroke of apoplexy. He lingered forty hours and died. It was the supreme blow.

Since his earliest youth DeForest had looked to his father as a mentor and friend. His grief was great and real and lasted for weeks. There was a bleak burial in the family burying ground in a wild part of western New York State. The funeral was indeed a sad one. For more than a month afterward DeForest could think of nothing else. It was a blight over his Commencement.

It was the final great experience which brought the crude, self-centered youth, the hard-headed, narrow-minded fanatical boy to a man's estate. It was the diploma of growth. Afterward, nothing could affect him greatly; he was a man.

DeForest had been brought up a "Yale man." His father, Henry S. DeForest, Yale '57, had taught his two sons from their infancy to love and revere Yale College. Lee was well familiar at home with his father's photograph of the "Old Brick Row," and the old dormitory where his father had lived, of the stately towers of the Old Library. Both boys had early inculcated within them a determination to go to Yale, to be "Yale Men." Consequently, when Lee saw this cherished ambition become realization it did not take long for his father's teachings of love and reverence for his Alma Mater to blossom from the depths of the son's soul. Few students at Yale felt greater enthusiasm or keener loyalty for the school than did young DeForest. This sentiment, this regard, deepened consistently as his years at Yale lengthened. Although, as a Sheff. man at that period, he was deprived of his darling ambition, to live in a college dormitory, and although on account of his poverty and lack of social training he had made but few bosom friends, yet, notwithstanding, he could frequently be found on the old Campus, in the rooms of certain academic friends he had made, seated with them on the old Yale fence in the glamour

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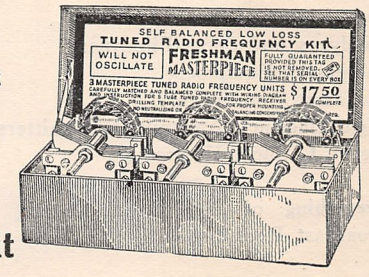

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of a spring evening, or late at night arm in arm with one or two cronies, singing the old Yale glees in the moonlight.

And to no son of Yale did these rare hours possess a deeper meaning, or grip the heart with a more poignant sentiment.

Thus, when in the spring of his senior year his classmates honored DeForest as one of their Class Historians, and especially with the commission to write the history of the Senior Year for the Class Book he fell to the task with a keen delight, and dipped his pen in the very blood of his sentimental heart.

Graduation was, of course, the most enjoyable incident of his life up to the time. There was much merry-making and the natural joy of the senior. It was the realization of his life's second great dream.

Graduation. Yale. Now life and more study, and work and success.

The College of the Air

(*Continued from page* 677)

grounds; a discussion of auto, truck and tractor troubles, and a dozen other subjects are listed. How to keep the baby from crying, how to keep your husband from growling, how to save your money, your strength, how to make dresses and hats look like Paris models,—all this will be taught any aspiring female who tunes in on Thursday evening. On Friday evening the division of General Science will present lectures on public speaking, business English, law, sociology, music, chemistry, zoölogy, and botany.

Forty radio courses, embodying the essentials of that number of college subjects of especial interest to farmers, will be broadcast throughout the school year. K. S. A. C. is the first institute in the world to offer a regular course of systematic instruction by radio.

KSAC are the call letters of the new 500-watt station now under construction on the college campus. The programs will be broadcast on a wave-length of 341 meters. School will start promptly at 7 p. m. each week night evening.

A 48-page radio college catalog which lists and describes subjects offered in agriculture, engineering, home economics and general science is being distributed by the Extension Division.

The elaborate program launched by the college this year is the result of a successful experiment conducted along similar lines last winter. A 10-week "College of the Air" program, broadcast from a neighboring station by remote control last winter, was attended by more than 1,000 regularly enrolled students. Half of this number took examinations over their radio work and were granted certificates.

The radio catalog and enrollment blanks for the K. S. A. C. radio course may be secured by writing the Extension Division, Kansas State Agricultural College, Manhattan, Kansas.

Radio in South America

(*Continued from page* 686)

now using 250 watts power in a modified DeForest type transmitter, the former French 500-watt set being out of use.

ARGENTINE REGULATIONS

Regulations have just been issued in the Argentine Republic, making it necessary to hold a license for a transmitter (not for a receiver). The terms are extremely liberal, allowing amateurs all waves up to 250 meters, and power in C.W., I.C.W. and

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telephony up to 500 watts on plates (200 watts if within eight miles of a Government station). In spark, up to 500 watts in the transformer primary is allowed, but this type of station is prohibited within eight miles of a Government station.

A knowledge of the Morse Code at a minimum of six words per minute is required, together with ability to recognize the licensee's own call, SOS, and AS when sent at 10 words per minute; however, amateurs are given until the end of 1925 to comply with this, receiving in the meantime a provisional license. This will undoubtedly lead to an enormous increase in the use of telegraphy, whereas at present practically only telephony is used.

No charge is proposed.

Broadcast stations are given the waves between 250 to 275 meters with powers up to 500 watts, and 325 to 425 meters with higher powers.

Amateur calls will have the form "DA8," this being the new call of the famous "CB8" of Bernal, near Buenos Aires, actually holder of the world's record distance for two-way working. The first letter indicates the district.

BROADCAST STATIONS OF ARGENTINA

L O R Sociedad Radio Argentina—Capital.
L O V Francisco J. Brusa—Corrientes 2037, Capital.
L O W Grand Splendid Theatre—Santa Fe 1860, Capital.
L O R Radio Cultura Av. Alvear y Canning, Capital.
L O Z R. S. A. Actualmente a cargo de la Asociacion Argentina de Broadcasting —San Martin 329, Capital.

Experimental Stations

A 1 Estacion Experimental de la Sociedad Radio Telefonica Argentina—Directorio 32, Capital
C 1 Faculatad de Ciencias Medicas—Calle Corboba, Capital.
C 2 Departamento Nacional de Higiene—Capital.
C 3 Buque Jenner del Departamento Nacional de Higiene—Capital.

College Education by Radio

By ROSE GERTRUDE KING

There are many college graduates who have taken the greater part of their college work in summer school sessions. There are many holders of A. B. degrees whose college study has consisted mainly of home study courses. Soon, however, there may be college and university graduates who can boast of having received the greater part of their college education by radio!

Already an entirely new term indicative of the new method of education has been coined, for Columbia University was recently referred to as "The University of the Air," because of the comprehensive college courses now being given via radio by that institution.

Modern universities and colleges, acting on the theory that if Mohamet can't come to the mountain, the mountain must come to Mohamet, have been quick to see that those who can not go to college must have college brought to them—and that the radio is the most effective means of bringing into the student's life not only the definite information comprising the college courses, but the personality of the professor, and the intangible but invaluable school spirit. The up-to-date college also believes that its duty is not alone to the relatively few who can attend college, but to all around it, and it rejoices in the opportunity radio brings it in broadcasting information of interest to the general public, in disseminating ideas helpful to women in their duties as housewives, and to men in their business or agricultural activities.

Many colleges have their own broadcast stations, often under the direction of one of the scientific departments of the school. At

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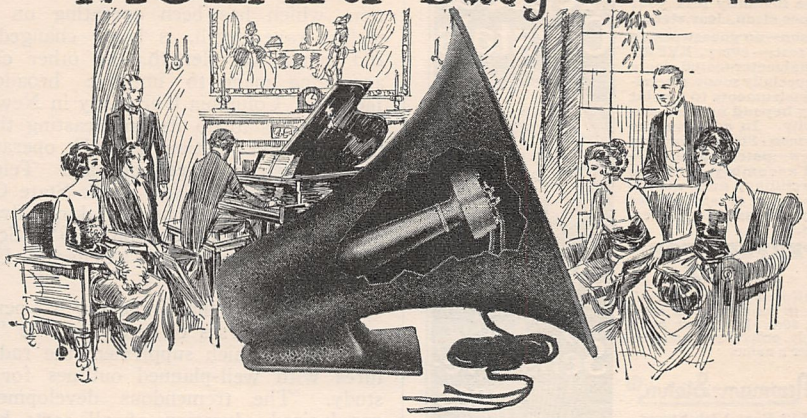

IT is a pleasure to quote this month part of an unbiased report from a noted firm of radio merchandisers, who have the reputation of knowing their business thoroughly.

"I made a personal test of your fine instrument in all of our five business places (cities as below) by direct comparison with—(here are mentioned 14 of the leading instruments on the market today, including some which sell at more than three times our price).

The sets used for testing were: Reinartz 3 tube, Grebe 4 tube, Neutrodyne 5 tube and Superhetrodyne 8 tube. The results follows:

City	Audibility	Resonance	Hyperacoustics	Percent
Fenton	Excellent	Excellent	Upper tones defective	95
Pontiac	Fair	Good	Flat	87
Detroit	Good	Excellent	Thin at peak	90
Flint	Good	Excellent	Thin at peak	93
Lansing	Excellent	Excellent	Straight at curve	98

Total percent for your horn—92.60

Your highest competitive horns rank from total percentages of 42% minimum to 84.15 maximum.

Your instrument is easily worth $40.00."

For the S. D. Radio & Elec. Co. (Signed) F. W. Dobbs, Fenton, Michigan.

PRICES . . . F. O. B. Factory.

Reproducer complete in black and gold crocodile finish with (gold plated) unit and cord $12.00
In black satin finish with nickel plated unit and cord..... 10.00
Electro-Magnetic unit only (fits almost any horn or phonograph) with cord, gold plated $5.00; nickel plated, $4.00
New Mozart-Radioceive Headset..... 5.00
Shipping weight of reproducer, 8 lbs. (approx.)
Dimensions—Diameter of bell, 12". Length and height overall 12½".
No extra batteries required.

Direct from the factory or through one of our authorized dealers

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Give full details. Say exactly what you want. We will send anything C. O. D. We are your servants.

If you are not certain what you want, give full details and results you wish and we will send the cheapest part, set of parts or receiving set for best results.

Prices lowest. No order too small or too large.

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RADIO *long-distance sets* COMPLETE

THESE are the *finest long distance* sets at the *lowest prices* in history. Wonderful new circuit that brings amazing results. SATISFACTION GUARANTEED. Everything furnished with complete sets. There's a set for *every pocket-book.*

4 tube set—with 3 dry cells, B Battery, 4 tubes, loud speaker, head phones, antenna $57.95
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The above 3 sets can also be furnished for use with "A" storage battery instead of dry cells, $12.00 extra.

1 tube set—with dry cells, B Battery, 1 tube, head-phones, antenna $19.95

Sets also sold without accessories. Also full line of radio accessories, 1 and 2 stage amplifiers and portable sets. Write for FREE catalogue—*don't buy until you see it.*

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In She Comes!

TIP YOUR whisker to almost any point of an NAA Meter tested crystal and the full flow of the impulse instantly hits your phones, clean, clear, steady. Reason—no guesswork in the test;—every, EVERY crystal meter-tested singly by specially made electrical instruments to a point away beyond normal sensitivity. In addition, the Newman-Stern mounting is new—patents pending—cold assembly, provides for refilling, and avoids damage to crystal by hot alloy; recessed for protection.

PERFECT FOR REFLEX

At all good jobbers and dealers, in neat turned wood box, 60c. If dealer can't supply, order direct and send dealer's name.

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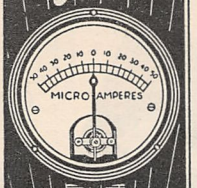
Originators of tested crystals in 1914, Oldest and largest producers. Pioneers in Radio Equipment in Ohio

PAT. PEND.

New NAA Meter Tested Crystals



Nuggets of Sensitiveness

METER-TESTED NEWMAN-STERN

Don't Be a Sickly Grouch!

Nobody loves a grouch—nobody likes to meet him in the street, do business with him or have him around. And you can't help being a grouch if your internal machinery is running wrong; if dyspepsia or biliousness make your life miserable; if headaches and backaches take the tuck out of you; if constipation is poisoning your blood and beclouding your brain.

GET RID OF YOUR AILMENTS

You are only half a man when you stagger along under such handicaps; you can't win out, you can't make a success of anything; you are bound to be a failure—you know it, your wife knows it, and all your friends know it. Don't lay it on your stomach or liver or lungs—take hold of YOURSELF—build yourself up into a MAN again: turn over a leaf and live life as Nature meant it should be lived.

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Send for My New Free Book "DO IT WITH MUSCLE"

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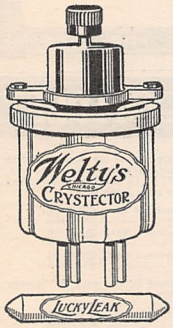

REDUCE BATTERY CONSUMPTION 50%
INCREASE TONE QUALITY 85%
MAKE YOUR SET TALK 100%
With a
CRYSTECTOR $4

Used instead of detector tube in Neutrodyne sets. Gives clearer tone, as it is crystal detection instead of tube detection.

Send for descriptive circular.

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Antioch College, Yellow Springs, Ohio, broadcasting is in charge of Professor Frayne, head of the department of physics. Purdue University, Lafayette, Indiana, broadcasts through its own station WBAA, which is in direct charge of Professor R. V. Achatz, of the School of Electrical Engineering, who teaches this subject in which several engineers major each year. This station, which has been operating on a 360 meter wave-length, is being changed to a 283 meter wave-length, and other changes are being made to improve broadcasting facilities. Columbia University in New York City prefers to do its broadcasting through the excellent station WEAF, operated by the American Telephone and Telegraph Company, and the New York State College of Agriculture in Ithaca is taking advantage of the nearness of Station WGY, Schenectady, in charge of the General Electric Company.

Already Columbia University has perfected systematic courses of study for its "listening" pupils which supplement the radio lectures with well-planned outlines for home study. The tremendous development of popularized education of all sorts has led some persons to believe that through radio, with its vastly greater possibilities along this line, learning can be quickly, painlessly and effortlessly absorbed, but Columbia students who learn by radio are expected to study the syllabus of their course, procured upon nominal fee, and study it as thoroughly as if they were in the classroom.

Variety of courses and high calibre of instructors characterize Columbia radio courses. For instance, one of the most brilliant and most popular of the younger instructors is Hoxie Neal Fairchild, Supervisor of Home Study Courses in English, who is giving a radio course of ten twenty-minute lectures confined to the work of Robert Browning. Unlike many courses which attempt to give merely a bird's eye view of English literature, or still more ambitiously, of world literature, his course proposes more than merely an interesting series of vague generalities, and limits itself to one poet.

For half an hour each Wednesday night Dr. Gardner Murphy, eminent psychologist of Columbia University, has been broadcasting a series of ten lectures on Psychology. There is a good deal of "meat" in all of Dr. Murphy's lectures, and this series took up the origin of modern psychology, going back to the work of the great psychologist, E. H. Weber, and the experiments of the first laboratory for psychology, established by Dr. Wendt in 1879, as well as a study of the modern trend of psychology. If capably handled there is much of real interest to the general public in psychology, and it has the advantage of being a fairly new radio topic. A syllabus, giving an outline of the talks, with assignments for reading and experiments to be done, was issued for the benefit of those desiring it by the Home Study Division. Letters and telephone calls from his invisible classroom expressed a very decided interest in Dr. Murphy's lectures.

Another Columbia radio course, which concluded August 17, was on the Old Testament and was conducted Sunday afternoons at 5 o'clock by Herbert B. Howe, Columbia instructor. Mr. Howe received his bachelor's and master's degrees from Williams College, and his B.D. from the Union Theological Seminary. He has held pastorates in Congregational and Presbyterian churches in various parts of New England. The ten selections from the Old Testament chosen for his course show the history of the nation in its change from wandering tribe to settled abode in the Promised Land, the perfection of government from the time of the judges to the three great kings, the

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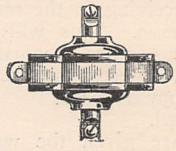

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Detector-Amplifier
Guaranteed
Rigidly tested by expert engineers.
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Special discount to dealers. A few more distributors wanted.
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Dealers, write to distributors in your territory

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Contains Special Coils and Tuned air-core transformers.

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Contains all you need to build an eight-tube receiver.

Sold on a Money-back Guarantee Basis

We also Build and Repair Everything in Radio
Write for Literature

BROADCAST SERVICE COMPANY
ONE UNION SQUARE, NEW YORK CITY
"Oldtimers in Radio"

division, foreign oppression, and exile. The selections were planned to cover the long development of 1,500 years from the primitive times in the desert to the day when Greek culture permeated the Near East and even the sacred writings of the Hebrews were translated into the Greek tongue.

Although Antioch College has not given definite courses by radio, it has experimented very successfully with the popularization of scientific questions. Believing that the general public would be more interested in such matters not only if they were presented in non-technical language, but also if they were given in a conversational manner, the college decided to employ the question-and-answer method instead of the straight lecture, and have two professors discuss scientific subjects together very informally.

"For instance," writes Miss F. S. Baker, Registrar, "one evening the head of our biology department and an instructor in the department of chemistry discussed the question, 'The Biology of Death' in terms that the average layman could understand. The chemist asked such questions as any ordinary person might ask, and these were answered by the biologist."

For the past three years Purdue University has used its radio twice each week, one night being in charge of the agricultural school, and the other the engineers. Although the agriculturalists give a good share of their lectures for the farmer, the poultryman, and the fruit grower, they do not neglect to include frequent talks of interest to the city gardener. The engineers feature topics of interest to every one, with a slant usually towards a non-technical treatment of some engineering problem, particularly those affecting the municipalities. That valuable contacts with a wider public are resulting is shown by the hundreds of letters received expressing interest in the programs, and in many cases, asking for further information. After this educational part of the program which never lasts more than fifteen minutes, results of university games are broadcast, and occasionally also events on the campus, such as large meetings, boy and girl club round-ups, and farmers' short courses.

While Cornell University in Ithaca, New York, does not broadcast any lectures, the extension department of the State College of Agriculture at Cornell co-operates with the New York State Farm Bureau Federation in broadcasting talks to farmers, each organization having two Monday evenings a month for its broadcasting. C. E. Ladd is director of extension work for the college, and E. V. Underwood, secretary of the farm bureau. Both organizations broadcast through Station WGY, Schenectady.

Taking up first the programs of the farm bureau, the variety of the farm problems covered by this organization in its radio talks may be best seen by a glance at some of the lectures given so far in 1924. Other organizations may find some suggested topics from among this list.

Former Congressman Peter G. Ten Eyck is among the notables who have recently given farm talks for the bureau. He emphasized the fact that the state of New York should develop its agriculture to the greatest extent possible and realize all the means at her command to increase the ratio of food production to meet the increasing consumption, due to the rapidly growing population of the state.

"New York is now a greater purchaser from other states than any in the Union," said Mr. Ten Eyck. "We as a state should devote our time, attention, and energy to fostering that greatest of all industries, the agricultural industry, in this state so that we can extend and increase our production at least in proportion to the increase in consumption."

Farmers' wives, as well as the farmers

KESTER Radio SOLDER

ROSIN-CORE

Oh boy it sure is Safe & Simple

Here's the solder that contains the flux recommended by radio engineers! The pure rosin core inside of Kester Radio Solder is a *natural* flux and can leave no harmful chemical or electrical action on delicate parts or joints.

It requires only heat, and as the solder is used the rosin flux flows out in the proper amount. *Not too much, not too little, but just right.*

In developing radio frequency it proved that all fluxes, except rosin, spatter, fume and run over delicate parts and joints. *This causes high leakage and reduces resistance to like values as grid leaks!*

Solder with Kester Radio Solder. You will have no need to go over and wipe away surplus flux. Leave what rosin may remain—it is a good insulator!

There you have it: Kester Radio Solder is a safe and simple solder with which your set can be *quickly, neatly, safely and substantially soldered.*

Get a handy can of Kester today from your dealer or send us 25c in stamps—

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Look for this carton on your dealer's counter!

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Gentlemen: Send me one can Kester Radio Solder, for which I enclose 25c in stamps.
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Name.....
Address.....
City..... State.....
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WE want one thousand agents to sell subscriptions to RADIO NEWS, SCIENCE AND INVENTION, PRACTICAL ELECTRICS AND MOTOR CAMPER AND TOURIST. We will pay a generous commission for this work and help you in every way. Our four publications are leaders in their fields, ready sellers and this is an offer well worth your while. A few spare hours a day will bring you a handsome return. Write regarding our proposition at once and be the first to get started in your vicinity.

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7400 miles with the *new* Stromberg-Carlson Neutrodyne Receiver

This record was reported by L. P. R. Bean, of Sydney, Australia, who heard "KGO" the Oakland, California station, using his No. 1A Neutrodyne Receiver and No. 1A Loud Speaker.

It proves that although these superb instruments are designed particularly for tone quality, freedom from interference, and for stability, they also are unsurpassed for distance with volume.

Stromberg-Carlson Receivers are beautiful in appearance; extremely simple to use—just set the dials at established points to get the sending station you want—and that station holds indefinitely.

Ask your Dealer. If he cannot supply you, write us. Descriptive folders free.

Stromberg-Carlson Telephone Mfg. Co.
1060 University Ave., Rochester, N. Y.

No. 1-A Portable Type

Portable 5-tube Neutrodyne Receiver in richly finished Adam-Brown mahogany cabinet. Arranged to operate with the No. 1-A Loud Speaker.

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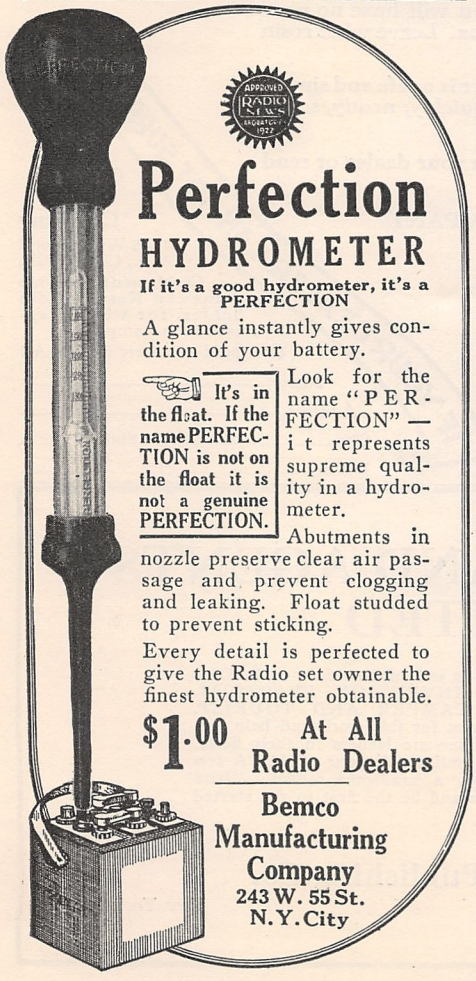

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If it's a good hydrometer, it's a PERFECTION

A glance instantly gives condition of your battery.

It's in the float. If the name PERFECTION is not on the float it is not a genuine PERFECTION.

Look for the name "PERFECTION" — it represents supreme quality in a hydrometer.

Abutments in nozzle preserve clear air passage and prevent clogging and leaking. Float studded to prevent sticking.

Every detail is perfected to give the Radio set owner the finest hydrometer obtainable.

$1.00 At All Radio Dealers

Bemco Manufacturing Company
243 W. 55 St.
N.Y.City

themselves, are remembered in the broadcast programs of the New York State College of Agriculture. Recently Martha Van Rensselaer, professor of the school of home economics, named as one of the twelve greatest women in the world, appeared on a radio program, lecturing on what the college is doing to teach better methods of home making.

"Planting Wheat to Avoid the Hessaon Fly," was the subject broadcast by Professor C. R. Crosby on September 8, and on September 29, Dr. W. I. Myers of the college farm management department talked on "Farm Credit." Among other interesting speeches to be broadcast soon by the college is that of Dr. Earl Bates on October 13, who will have as his subject, "Indian Tales and Trails of the Mohawk Valley."

The college is also broadcasting through its weather bureau a special daily weather forecast to farmers in eight New York counties, in order that they may more safely and surely plan harvesting operations. Albany, Fulton, Montgomery, Rensselaer, Schenectady, Saratoga, Schoharie and Washington are the counties receiving this radio service, the other counties having a telephone relay system whereby they call up certain persons who have been designated as distributors.

Weather forecasts are made daily except Sunday at 11:45 A. M., Eastern standard time, on a wave-length of 380 meters, broadcast, like the other college programs from WGY, Schenectady. They follow the general forecasts for New England, New York and Eastern Pennsylvania.

The following are the terms used, and their meaning: Fair, part cloudy, cloudy—no rain expected. Rain—general rain of several hours' duration. Clearing—end of rainy spell approaching. Showers—rain at intervals, probably light. Thunderstorms—local storms, but forecaster unable to specify exact locality, time, or intensity.

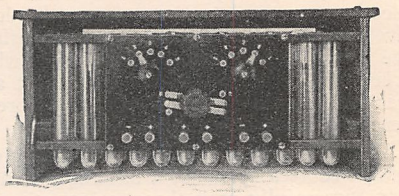
The forecasts are stated to indicate on a scale of 50 (doubtful) to 100 (practically certain), the weight which the forecaster thinks should be given to the forecast. "Strongly indicated" means a weight of 90 to 100, "indicated" means 70 to 80, and "unsettled, probably," means 50 to 60.

The success of radio educational service in general may perhaps be gauged by the response from the farmers of the state of New York to the work of the State Agricultural College. In a query sent out by the college as to whether the farmers wished the work continued and how often they would like to have the programs presented, 507 out of the 555 replies showed emphatic appreciation of the lectures by representatives of the college.

A large majority, 369, thought these programs by the college should be given weekly. Eight would like broadcasting daily; 77 prefer it twice a week; only 25 think twice a month is enough; and but 13 voted for only once a month. For the present the college expects to hold to the regular schedule, broadcasting on the second and last Mondays of each month.

All of this seems to indicate that the possibilities of education by radio are just beginning to be glimpsed. When more colleges awaken to the opportunities offered by the radio more and better ways of utilizing these vast resources will begin to be discovered.

Since many college courses consist entirely of lectures, with a written examination at the end of the term, there is practically no meeting of the personalities of student and professor. In many cases the instructor delivers the same lectures term after term to students who look to him very much like those of preceding years. Naturally his personality is submerged, his voice



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We have thousands of unsolicited letters of recommendation. KIC-O "B" batteries will make good for you, too. Life unlimited. Not harmed by short circuiting, overcharging, idleness. Panel switches give single cell variations. Recharge from any 110-volt A.C. line with small home rectifier. Charge lasts 3 to 6 months in detector plate circuit.

Volts	Price Plain	With Panels
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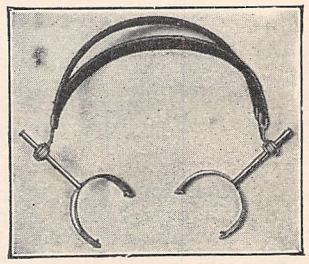

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monotonous. Radio lecturing being new, and his audience unseen and doubtless new, the professor's interest is challenged as to the personnel of his class; he realizes that he must inject personality into his voice to make for the absence of personal presence—and the result is a re-vivified, forceful, human lecture.

With radio giving to universities the whole world for a class-room, the universities of the future may be much more than secular colleges, or endowed universities for the few, or state institutions—they will be truly Universities of the World!

TO STUDY RADIO MYSTERIES AT SEA

Radio is coming to play a very important part in the plans of the Conference on Oceanography called by Secretary of the Navy Wilbur to outline a world-wide scientific study of the seven seas and the air above them. Among the many subjects under consideration by this conference, now in session at the Hydrographic Office, Washington, D. C., is the improvement of radio communication.

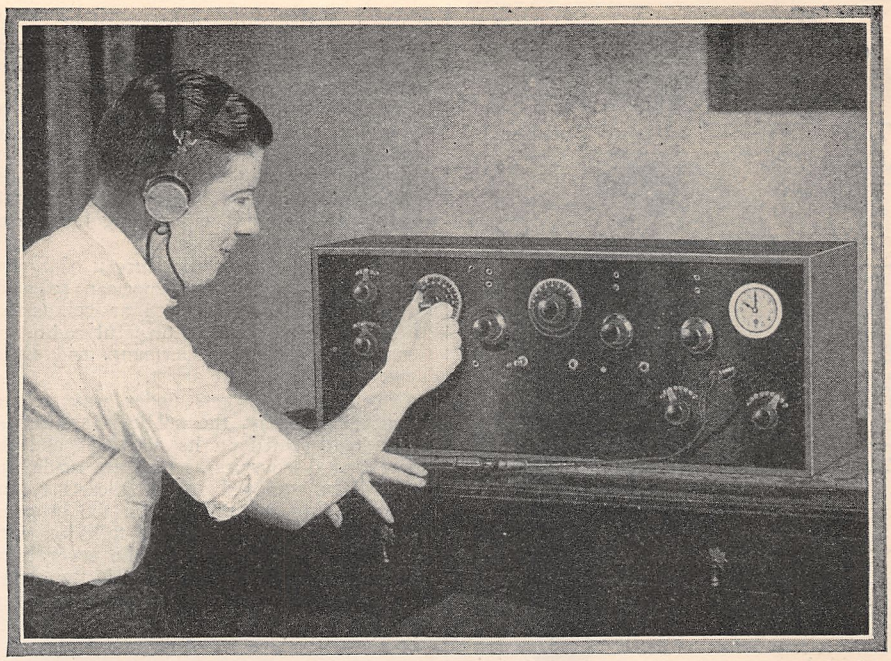
The radio personnel of the committee includes Dr. A. H. Taylor of the Navy, Dr. Louis Cohen of the Army Signal Corps, Dr. Austin of the Bureau of Standards, Capt. Ridley McLean, Director of Naval Communications, Brig. Gen. C. McK. Saltzman, Chief Signal Officer, and Lt. Col. C. A. Seaone, Signal Corps.

The Naval Hospital Ship *Solace,* acquired during the Spanish-American War, will be designated by the Navy as the cruising laboratory after she is re-commissioned and equipped with the latest radio apparatus. The first cruise will probably start in July, 1925, and will cover the Gulf-Caribbean area; later, cruises of the American scientists or their foreign associates being planned to cover all the waters and most of the ports of the world.

The chief aim of the scientists, as far as radio is concerned, is to re-route trans-oceanic radio traffic where atmospheric disturbances are found to be detrimental to direct transmission. For this reason one of the problems is to locate and chart centers of static disturbances so that they may be avoided in setting up long-distance circuits. At the suggestion of Dr. Cohen a special investigation will be made of static centers both at sea and ashore. He has communicated with the American Section of the International Radiotelegraphic Union, requesting further co-operation in developing plans for collecting the data desired for the solution of radio traffic problems.

It is understood that attention will be given to the study of intensities of radio signals from high-powered land stations when the *Solace* is at sea, and the co-operative efficiency of long- and short-wave transmissions. Although long wave-lengths are used for distant transmissions today, there is a tendency toward the use of short waves, which may be found more efficient and less expensive.

When the *Solace* sails next summer she will carry the best possible radio equipment and a modern sonic depth finding and ranging apparatus. She will be equipped for transmission and reception of radio waves through the air, the earth and water. The propagation of radio waves under the water will be a special problem to be worked out with the aid of some naval submarines. Even the transmission of radio impulses through the solid earth will be investigated, for scientists are anxious to ascertain whether radio waves pass through certain geological structures or around them. The projection of radio waves directionally by a process of focusing the transmitting antenna will also be studied in the desire to establish a radio beam, like that of a searchlight,



With the clock in his panel Mr. Kent checks time with the Government signals from Arlington and keeps track of broadcasting schedule. Note the beautiful finish of the Celoron panel.

What Kent says about Panels

Albert Kent builds his own sets. He uses instruments of the highest quality. He has found that it does not pay to mount his parts on just any old radio panel. He writes:

"Having completed over thirty radio receivers of various styles, I thought you would like to know of the truly wonderful results obtained with the use of Celoron panels.

"By the process of elimination, I found that Celoron was the only satisfactory panel, mainly because of its extremely low loss of high frequency currents. This characteristic brings in distant stations clearly with a simple hook-up. I find working with Celoron a pleasant task and every completed receiver makes a strikingly beautiful appearance. The first one, after three years' hard use, still looks like new.

"I wish I could tell every experimenter to begin building his set in the right way by using the best obtainable panel—and that is Celoron."

For set builders we have a special free booklet, "Getting the Right Hook-Up with Celoron." It contains valuable hints for set builders. Write to Department 4A for your copy.

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You will like the working characteristics of our tubes, as they are absolutely correct in Vacuum and Filament.

Send them in P.P. and have the satisfaction of knowing that your tubes are as efficient as scientific methods can make them.

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An improved Loud Speaker made by loud speaker specialists.

Will operate on any set of three tube capacity up to the eight tube super heterodyne.

Guaranteed to reproduce voice and music in perfect mellow tone, with plenty of volume.

No extra batteries required.

25" high
11" bell

Three finishes: Black, Olive Green or Brown Crystalline.

With gold plated ferrule connecting fibre horn with base.

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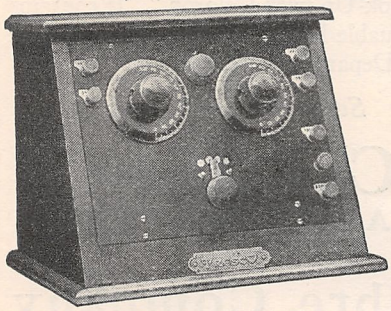

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for a short time only, send us your old crystal set and we will send you one of our $25.00 beautiful tube sets for the small sum of $12.50; add P. P. on 10 pounds. Circulars, 2c.

Tubes batteries, phones, etc. extra.

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Baldwin Phones Free

for best long distance record on my hookup. Other prizes too. Particulars free.

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in place of the ordinary spherical or broadcast method. The Naval radio compass used over limited distances for finding directions and locating a vessel by aid of land stations, it is hoped can be improved and its range extended if a directional beam effect can be secured. Such an improvement to the radio compass might make it possible for vessels crossing the Atlantic to navigate solely with their aid, eliminating the use of astronomical observations.

The co-operation of the Bureau of Standards experts and other American scientific radio investigators is assured, as well as that of Senatore Marconi. Powerful radio stations such as Nauen, Germany, and Eiffel Tower in Paris, will assist.

Once the vessel gets under way at sea, Naval experts say, the public is assured of being kept posted on its activities and the interesting discoveries as they are made, for she will be equipped for broadcasting, and is expected to report daily on the progress of her investigations. Radio talks on various phases of the work by the several experts aboard may prove unique in the annals of radio broadcasting and of scientific investigations.

COMES THE RADIO CRITIC

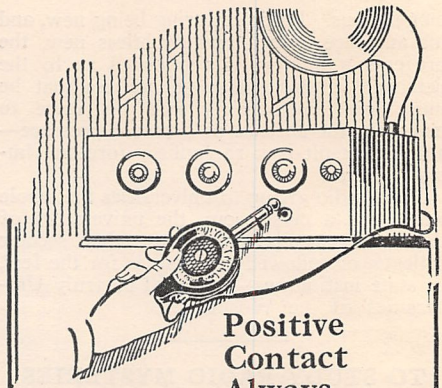
It may not behoove a radio writer to criticize the radio critic, but it is a new vocation and someone should do it.

Readers of radio columns have, no doubt, noticed a new type of writer has come into the radio field—the radio critic, or better, the radio broadcast critic. There are such men in New York, Boston, Brooklyn, Newark, and Washington, at present. They call their comments by various names indicating the nature of their effusions, some of which are good and some of which are not fair to the broadcasters. Some are well written and some are not.

Since the radio critic is in a unique position, the nearest comparison perhaps is with the activities of the dramatic critic. The latter's qualifications include a knowledge of drama, history, literature, stage history, and probably music. He must possess a good background, gained solely by experience, a large acquaintance with actors; be a judge of dramatic ability and possibilities. He should understand human nature and be sensible to the many emotions portrayed on the stage, analyzing and interpreting them and the plays he sees for his public. He doesn't have to be an author, an actor, a scenic artist or a stage hand. Usually a theatrical critic is a trained student of the dramatic art.

It would be better, probably, if the radio critic were not a radio expert, operator or writer, for he need not comment on poor transmission or radio mechanics; the listener knows as well as anyone, how the stuff comes in. The radio critic, in the opinion of experienced listeners, should comment on the entertainment and the artists, comparing their selections and their abilities with others of known standards, both at home and abroad. At present, these critics stick pretty closely to home stations, knocking performers and their efforts, sometimes in anticipation of the actual renditions. Most critics listen in and then write their comments, but all should do so. Eventually they will *have* to follow this practice, like their dramatic brothers.

It would be difficult to find finished radio critics immediately—they must be trained. Broadcasting history must be made to establish standards of performance. However, it is questionable, in the minds of some fans and writers, whether the critic of the entertainment on the air should know anything about radio at all. Ideally, they believe he should be a student of drama, music and human nature. And, most important, he should study station programs, performers



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Eliminates every inconvenience so annoying in the operation of the unsatisfactory screw type plug.

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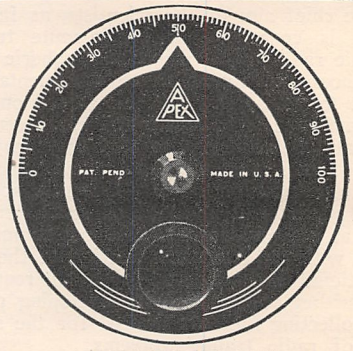

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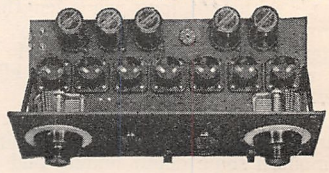
Do not bother with geared condensers, requiring many holes in the panel and careful lineup of pinion shafts, when this marvelous instrument provides the fine adjustment for tuning in distant stations. Ratio 10 to 1—quickly applied to any shaft. For sale by all good radio dealers. If unable to obtain, fill in coupon and enclose $2.50 for nickel finish or $3.50 for Gold Plated finish.



Coast to coast on an 18 inch loop

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—on a 7 x 18 panel in three hours, $97.50 buys the parts complete, including drilled and engraved panels, condensers, sockets, transformers, dials, connecting plugs, cables, etc. with drawings, diagrams and instructions. Price of cabinets to fit—furnished on applications. If your dealer cannot supply these parts for this complete Microdyne Radio Set, fill in coupon, mail check or money order and send dealer's name.

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Dept. 1106, 1410 W. 59th Street, Chicago

Gentlemen:—Enclosed find $..... for which send me .....
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and their selections, making comparisons with broadcasts within range of his readers' sets. Necessarily, he must have the best receiving set possible, in order that he may pick up distant stations, eliminating local interference. Unfortunately, so far, few radio critics are provided with good sets.

Experience alone and a good memory will serve him in writing in advance of the features offered the listeners; here a daily study of programs is required, and a knowledge of artists' past performances is of great advantage. He can sell the good performers to his readers, pointing out the selections likely to be good or of exceptional interest. This will save time and insure a good evening. The regular listener-in will appreciate early tips on the best offerings to come, as well as comments on past performances, which he can check against his own impressions. Constructive criticism is what most of the broadcast listeners want, with advance news on coming events or entertainment.

The critic must bear in mind one thing, at least for the present; only a few stations are employing paid or professional talent, most of them are using volunteer artists and many amateur performers. The comparison of stations in the two classes isn't fair. Imagine comparing two vaudeville houses, one of which employs professionals and the other depends upon amateurs. Another thing is the use of copyright music, which some stations are not able to transmit, for one reason or another, although an adjustment in this matter is anticipated. This restriction naturally limits selections at many stations, giving others a great advantage.

BROADCASTING DEVELOPING IN GERMANY

Germany's broadcasting system is gradually expanding and will soon include nine high-powered stations so located as to guarantee uniform reception in all parts of the country. The radius of the central stations will be increased eventually through intermediate broadcasters established in areas where the central stations are not heard properly.

The recently completed station at Stuttgart, which operated daily to a distance of 150 kilometers on a 437 meter wave, like the other six major broadcast stations, is owned and operated by the Federal Telegraph Administration, which collects a fee of two marks per month from subscribers through the post office. Stuttgart is not only heard all over Germany, but in England, Sweden, Norway, Denmark, Holland, Austria and Switzerland, when weather conditions are good. The other operating stations are in Berlin, Breslau, Frankfurt, Hamburg, Leipzig and Munich. Koenigsberg and Munster have stations nearly completed.

Regulations in Germany are stricter than in this country and American fans may be surprised to learn that even receiving set owners must secure licenses from local postmen and pay in advance for broadcast programs. Of course all transmitting sets are licensed and subject to confiscation for breaches of regulations; houses may be searched without warrants if owners are suspected of breaking rules or conducting unauthorized communication. Native sons have little difficulty in securing a listening-in license, but foreigners are required to register and provide identification, and their countries must grant reciprocal privileges. France is not among the nations listed, whose citizens are eligible to secure receiving permits. Some leniency is granted for portable sets, and, with permission of the police, an antenna may be strung from a telegraph pole, if costs are paid, which is a concession American fans would enjoy. Owners

Radio loss

Reddy HOT

Soldering Furnace

—a complete soldering outfit for every home use

for Radio

Mr. E. D. Fahlberg, former professor of Metallography at the University of Wisconsin and Metallurgical Engineer of Western Electric Company now announces the Reddy Hot Soldering Furnace for all-around home use and especially in radio work.

Radio News for August, 1924

A soldering iron, even one of the smaller electric irons, is rather a clumsy tool for soldering small wires and parts such as are used in a radio set. It is a much more convenient method to use an alcohol lamp, such as a jeweler uses, for this class of work; and a much neater job will be the result.

All supplies in this self-contained soldering outfit are made from tested formulas that are being used commercially by the biggest radio manufacturing companies and laboratories.

Reddy Hot Soldering supplies are obtainable through the same dealer that will show you the Reddy Hot Soldering Furnace.

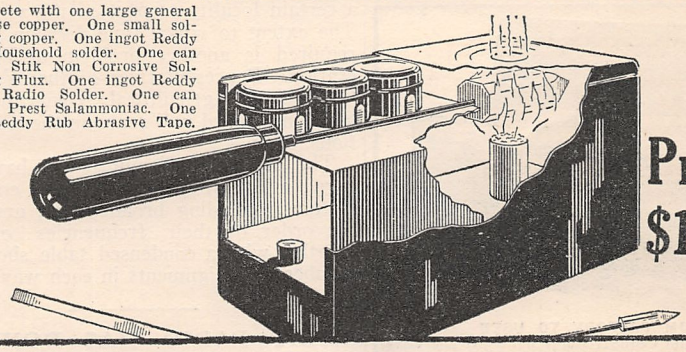
If not yet obtainable through your present source of supply, we will, for a short time only, ship postpaid upon receipt of price. Absolutely safe solder and flux.

E. D. FAHLBERG MFG. CO.
Madison, Wis.

Safe—Non-Explosive—Portable

Jobbers and dealers write or wire for the Reddy Hot Proposition and Samples. Display carton of 12.

Complete with one large general purpose copper. One small soldering copper. One ingot Reddy Flo Household solder. One can Reddy Stik Non Corrosive Soldering Flux. One ingot Reddy Melt Radio Solder. One can Reddy Prest Salammoniac. One can Reddy Rub Abrasive Tape.



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Send me prepaid one Reddy Hot Soldering Furnace for which I enclose $1.50.

My dealer's name is .....

Signed: Name .....

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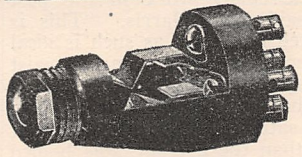

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No soldering necessary.
Connections made to neat binding posts.
Moulded completely from bakelite.
No metal in frame.
Short springs of special phosphor bronze.
Sterling silver contact points.
No. 30—Single circuit open ...$.80
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RADIO PRODUCTS are
UNQUALFIEDLY GUARANTEED
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Look for the Distinctive GREEN CICO BOX

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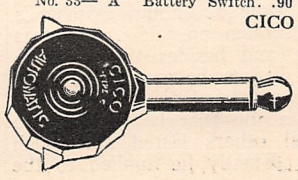
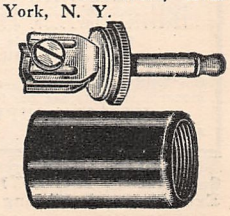


CICO AUTOMATIC PLUG

Gives instantaneous connection.
A slight pressure on the wings releases tips for change.
Nothing to take apart—no tools—no set screws.
Bakelite body. Metal parts nickle-plated.
Takes all tips. Price 75c.



CICO 2-WAY PLUG

Two sets of headphones or loudspeaker and one set of phones may be connected simultaneously. Fits all standard jacks. Takes all types of tips. Price 40c.

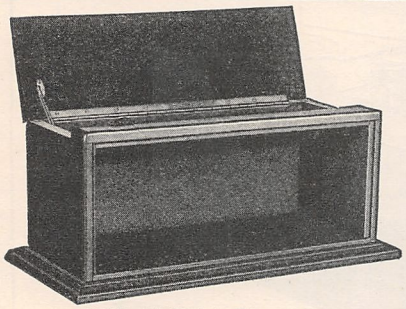
Exclusive improvements make it superior in performance.

SUPERSENSITIVE STETHOSCOPE ATTACHMENT eliminates the use of head phones.

ONE-PIECE HORN, SILVER PLATED METAL PARTS. Best workmanship and beautiful gray crystalline finish throughout. Tuning in with Stethoscope in ears, then one turn on lever cuts off Stethoscope and operates the horn. No plugging in and out of Radio Set. Lever Controls Sound Volume.

Model H-8 with smaller straight horn, with one set of Stethoscope, $18.50.
Extra Stethoscope Sets, $1.50 *each.*

DUAL LOUD SPEAKER CO.
210 West 54th Street New York City



FROM FACTORY TO USER

High Grade Radio Cabinets sturdy built and fine looking. Built from select genuine black walnut or birch. Elegantly finished. Tops on all cabinets hinged. Fronts of cabinets are rabbeted to take panel. Walnut cabinets have continuous piano hinges and lid holders. Birch cabinets have regular hinges. (No lid holders). Walnut cabinets finished in French walnut. Birch cabinets finished in Adam brown mahogany. (Panel not included). Money back if not satisfied.

For Panel	Deep	Birch No Base	DeLuxe Black Walnut	Monarch Black Walnut
6x 7	7"	$1.75	$3.75	$4.40
6x10½	7"	2.25	4.65	5.35
6x14	7"	2.75	5.45	6.20
6x21	7"	3.25	5.90	6.80
7x12	7"	2.80	5.50	6.50
7x14	7"	3.00	5.80	6.70
7x18	7"	3.25	6.00	6.80
7x21	7"	3.60	6.50	7.40
7x24	7"	4.10	7.25	8.00
7x26	7"	4.75	7.80	8.50
7x27	7"	5.00	8.50	9.00
7x28	7"	5.25	9.50	10.00
7x30	7"	6.00	10.00	11.00
7x24	10"	5.60	9.25	10.00
7x26	10"	6.25	9.80	10.50
7x27	10"	6.50	10.75	11.50
7x28	10"	6.75	11.50	12.00
7x30	10"	7.00	12.00	12.50
8x40	8"	6.00	11.50	12.50
9x14	10"	3.95	6.40	7.00
9x21	10"	5.00	7.70	9.25
9x24	10"	6.00	9.50	10.50
12x14	10"	4.25	7.00	8.00
12x21	10"	4.75	9.50	10.50

Mounting Boards all sizes in stock.
F.O.B. Milwaukee, Wis.

Circular showing our complete line sent on request. Our Utility Beauty Cabinets are really beautiful. Our Monarch cabinets are the best obtainable.

UTILITY SUPPLY COMPANY
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Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

of hotels and exhibitors must pay 30 marks a month for the privilege of furnishing guests entertainment.

The government is generous in one other respect; fees may be waived in the case of war cripples, and blind persons, who cannot attend public performances or are poor. Hospitals and homes for the ill and infirm are exempt from broadcast and license fees, while scientists and investigators, co-operating with the radio broadcasters, may be excused from paying radio taxes.

Detector and audio receivers may only be used on wave-lengths between 250 and 700 meters, the main broadcast band being from 392 to 485 meters. Radiating and oscillating sets are forbidden. As the Germans put it, "Receivers fitted with audion must be so constructed that they do not swing even if the tension is increased."

GOVERNMENT RADIO COMMITTEE WORKING OUT PLANS

Co-operating with the Department of Commerce the Inter-Department Radio Advisory Committee met on August 28 and outlined recommendations to be studied by special sub-committees of Governmental experts for submission as advice to the Government representatives designated on the Radio Conference Committee.

Their recommendations formed three main groups, covering a revision of wave-length allocation, broadcasting and reduction of interference. Under broadcasting the necessity of revising the class requirements and the elimination of Class C stations was noted. The encouragement of high-grade programs is sought through interconnection of stations by wire and radio. The subject of maximum power for broadcasters in populous centers will be investigated, and it may be suggested that these stations be transferred elsewhere. This subject is akin to another which aims to limit the number of stations in a certain locality as part of the zoning plan. The extent to which time division should be required is another problem under consideration. Representatives of the War, Navy, Commerce, Agricultural Departments and Shipping Board will serve in these investigations.

The Advisory Committee is having prepared a list of government and commercial stations, including broadcasters, arranged in the order of their frequencies or wave-lengths, with a condensed table showing the number of assignments in each wave band.

WHAT RADIO HAS DONE FOR THE CRIPPLE

That radio has proved a boon to the cripple is acknowledged by Miss Sylvia Harris, head of the employment department of the Institute for Crippled and Disabled Men, 245 East 23rd Street, New York City.

"We have placed more than 50 crippled boys in radio assembly work in the past few months," said Miss Harris. "This is distinctly a seated trade and as such is ideal for the man who is crippled from the waist down. Two capable hands are all that is needed, and it has been found that crippled men are more satisfactory in this kind of exacting work than the average able bodied man of the same mechanical ability.

"Michael Winburn is a good example of what radio has done for the cripple. His background was that of the average unskilled workman. With his left leg completely paralyzed, and his general health undermined by the effects of a bad heart, it looked for a time as though Michael's home would be broken up. His wife was too ill to work, and besides there was a small child who had to be cared for. For three years Michael tried to secure work. Once he found a job that lasted for two months. Several others lasted for much shorter periods. Finally he applied to the

How to Locate Troubles in Your Radio Set

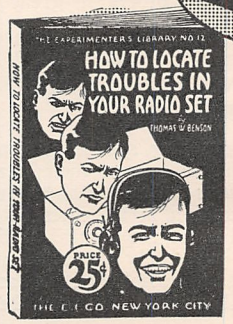
When something happens to their Radio Set five people out of ten do not know what to do. CONSRAD has a book that tells you what to look for, just as the Auto instruction book tells you how to locate troubles in your car. How to test the batteries to see if they are fully charged, how to trace all leads to and from the batteries, how to locate faults in the Radio frequency and Audio frequency circuits, etc.

The book is complete in that it takes every step in the modern radio receiving sets and outlines what possibly might happen to each.

Contains 52 pages, finely printed, complete with pictures and charts, bound with extra-heavy cardboard cover printed in two colors. Buy a copy today for emergency.

AT ALL RELIABLE RADIO and NEWS DEALERS

PRICE 25¢



BOOK No. 12 How to Locate Troubles in Your Radio Set

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CONSRAD—Selling Agents
233 FULTON STREET, NEW YORK CITY

SUPERTRON
A GOOD TUBE
ALL TYPES $4.00
All Good Dealers Sell Supertrons
VICTOR RADIO MFG. CO., 32 Union Sq., N. Y. C.

RADIO HORN
exactly like picture, made of heavy black cardboard, sent complete, ready to glue together for 50c. Just the thing to use in a cabinet. Improved Radio Log Book, 25c. A log book and two horns (one for each receiver) for only $1.00.
50c
FOX MANUFACTURING CO., DEPT. B
247 So. Broadway, Los Angeles, Calif.

REFLEX
Erla—Acme—Harkness
Dealers: Send for Discounts
HUDSON-ROSS
123 W. Madison St. Chicago

Institute employment bureau and was placed in radio assembly work. This was during December. The wage to start with was $18.60. Recently his wife called to say that Michael, in two months' time, has not only been promoted to the position of foreman, but that his salary has been increased to $29.50.

"Roland Wells had even a greater handicap to start with than did Winburn. One of his legs was amputated at the knee—the other was totally paralyzed. Unable to get about, except with the aid of two crutches, it looked as though he would have to spend the rest of his life dependent upon public support."

It was on May 12, last year, that Miss Harris found a job for Roland. A room was secured for him across the street from his work. After three months, Roland was made supervisor of the bench, and after nine months he was given complete charge of all assembly work.

It took Alfred Webb ten minutes to say "good morning." And after he finished you wished he had said "goodbye" instead. There was something unattractive about him—an utter lack of dash and spirit that to the casual observer seemed unforgivable. Was it the boy's fault that he was born this way—with his both legs paralyzed, and an impediment in his speech? His family was tolerant rather than kind, and in school it was exactly the same.

Last September the Institute found him a job in radio assembly work at $15 a week, and after six months his employers look upon him as one of their most capable workers.

Financial independence is the thing Andy Herman, another leg cripple, achieved through radio assembly work. He now has a business of his own.

HOOVER WANTS NATIONAL BROADCASTING NET—INTERCONNECTION FOR NATIONAL AFFAIRS

Secretary Hoover believes it is important, so that all may keep posted on national affairs, that the whole country be connected by radio and wires. The connecting of broadcasters into chains was one of the most important questions raised during the Conference September 30.

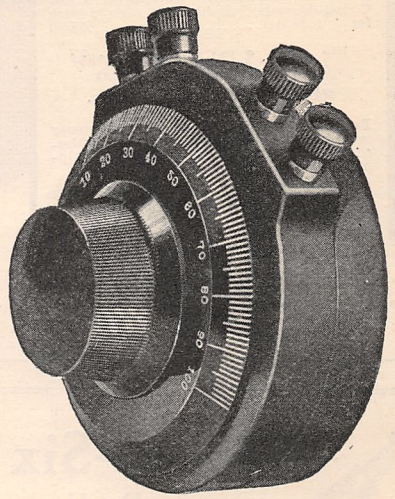
Discussing the radio sessions over which he presided, Secretary Hoover said that the big question was the interconnection of broadcast stations in every city with better organization. Through the co-operation of the broadcasters with the American Telephone and Telegraph Co., he said the eastern half of the nation, was well served when events of importance were broadcast, but added that some parts of the country were not yet reached and that therefore the citizens might be said not to participate in national affairs. "It is important to have the whole country connected for events of general importance," he declared. "Real public service," he explained, "lies within the power of local broadcasters in all states."

At present the situation falls considerably short of Secretary Hoover's ideal, due, as he pointed out, to lack of complete co-operation between the transmitting stations and the companies controlling the telephone and telegraph wires, and the necessary expense involved. Today several high powered broadcast stations are spanning the country, with listeners in many cities, but this does not meet the rigid requirements set up by Mr. Hoover, who has long been held the friend of the radio public. He wants an efficient station in every town so as to insure the owners of crystal sets at least a "silent part" in country-wide activities. Every local station must be efficient, and capable of being linked into a national net for the dissemination of important communications and the diffusion of official pro-

DeRoy
TRADE MARK
Phusiformer
"NO-LOS"
Manufactured under license agreement

The NEW Easy Way to Build and Re-build Sets!

ONE UNIT—the *De Roy Phusiformer*—instead of condensers, couplers, radio frequency transformers and variometers requiring involved wiring and complicated tuning. Increasing the power of your set, or changing your hookup is simply a matter of adding more *De Roy Phusiformer Units* to the circuit. The *De Roy Phusiformer* consists of a telescoping series of coils lying in a non-inductive field. Far more sensitive than the instruments it displaces—bringing in programs from great distances surprisingly clear and loud. Selects with positiveness. Permits "logging" of stations. Absolutely NO distortion, radiation or oscillation!



Price Complete with Bakelite Dial **$9**

How to Buy DeRoy "*No Los*" *PHUSIFORMERS*

This new radio unit is so revolutionary and the demand already so great that we naturally have not been able to supply all radio dealers. Therefore, do not give up the idea simply because you cannot buy it locally. Just send us your money-order and we will fill your order direct. Be sure to mention dealer's name. Satisfaction guaranteed.

Write for Literature—mentioning the name of your dealer

Watch for Announcement of the New DeRoy "No-Los" Phusiformer Receiver

If your dealer doesn't carry the DeRoy Phusiformer send Nine Dollars direct

DE ROY RADIO CORPORATION

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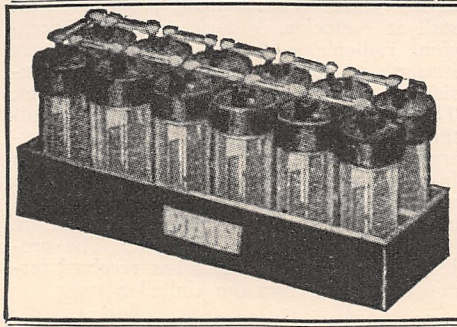

Main Storage "B" Batteries

Soon save their cost. They improve reception, and are more satisfactory. Rechargeable at home from house current. Now available in rubber trays, at no extra cost. Write today. Dealers get our proposition, best ever.

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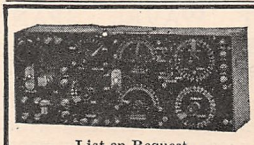

List on Request.
GEORGE EATON
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NAVY CN113

Receiving set 300-2500M Tunes DX - Broadcast, Ships and Ares. Terminals for Attachment of Audion. Crystal Detector on Panel size 7"x 17"x5". Cost $150. Price postpaid $21.50

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ULTRADYNE Kit containing 1 type "A" ultraformer, 3 type "B" ultraformers, 1 tuning coil, 1 oscillator coil, 4 matched fixed condensers $26.00
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FRESHMAN MASTERPIECE — the new "tuned Radio Frequency set." (A constructed set—not a Kit.).....$60.00

ATWATER KENT receiving set, the new Model No. 20 .....$100.00

GENWIN COCKADAY Unit (with A, B, C and D coils), double silk covered wire for 5 tube set.....$5.50

We allow 10% *cash discount off above list prices when cash accompanies order.*

Remit by Post Office or Express money order payable to us New York City. Merchandise sent Parcel Post or Express, shipping charges collect.

NOTE—The Durell Buying Service can obtain for you practically any Radio Equipment.

THE DURELL COMPANY
98 PARK PL.
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Set-O-Six
Radio Socket Wrench

$1.25

A solidly-built wrench for every radio need. Reaches and fits every round and hexagon nut on any set; works with a fast, screw-driver turn. Compact, light, and handy.

If your dealer cannot supply you order from us

THE PERRY-FAY COMPANY
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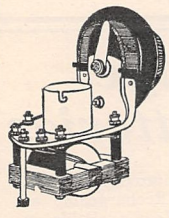

3 IN 1
Amplifying Unit
$7.00

Transformer, Rheostat and Socket

All in one, completely wired, ready to mount on panel, dial included.
Same unit without transformer $2.50

Simplest - Cheapest

method for amplifying your present set or for construction of a one to five tube set receiver. Blueprint showing how to build five-tube neutrodyne using these units 50c.

Discount to dealers and builders.

Wm. A. Welty & Co.
36 So. State St. Dept. 10 Chicago

nouncements, before this exponent of the radio communication is satisfied.

A glance at his proclamation for the Third National Radio Conference will show, from the very subjects to be discussed, that his aims for this country's communication system are indeed high. Among the subjects to be studied and analyzed by representatives of all the phases of the radio art are: Classification of stations and wave-lengths, interconnection, elimination of smaller and inefficient stations, reduction of interference, and relations between the government and commercial stations.

About thirty official representatives from the several interests including the industry, operators, amateurs, broadcasters, listeners, government and marine services will be announced as soon as their organizations present the names to the Secretary. This body will constitute the active committee. In all probability the committee will be organized into several sub-committees for better handling specific questions. Mr. Hoover aims to have the committee representative of every active part of the radio art and industry; from engineers to the lay listeners, all will have a voice. The public manifesting interest will also be admitted to the general sessions, it is stated. Although the list of invitations sent to organizations has not been made public it is understood that such organizations as the following are included: The Radio Corporation, American Tel. & Tel. Co., marine radio operating companies, American Radio Relay League, the electrical and radio engineering associations, and the broadcast organizations. Each Radio District Supervisor has been requested to call a meeting of the broadcasters in his section for the selection of a local representative, and the radio magazines, at a recent meeting in New York were to select their delegate.

The most astounding thing is that the suggestion of the past two conferences and the resultant regulations of the Department, were practically all accepted voluntarily by the radio world at large. In the absence of adequate legislation on radio and the growing congestion of the ether, there was nothing for the Commerce Head, under whose direction the regulation of matters radio falls, to do but place his problems before another representative conference asking for further recommendations, which are likely to operate more efficiently, perhaps, than inflexible laws and regulations laid down by an unsympathetic and poorly informed Congress.

PARAGUAYAN SEEKS RADIO RIGHTS

Eduardo Rojas & Cie., of Asuncion, Paraguay, is seeking exclusive rights to import free of duty and sell radio transmitting and receiving apparatus in Paraguay for a period of five years. The company promises to install at Asuncion, Villarica and in Concepcion, radiophone transmitters of sufficient strength to communicate with stations outside the country, particularly Buenos Aires. The organizers to be known as Radio-Cultura Paraguay, would also provide the Government with 14 receiving sets, and build a factory for manufacturing radio apparatus and accessories. They also promise to permit Government transmission on certain hours daily and in emergencies. The projector of the plan already has received certain equipment from the United States.

NAVY'S SHORT WAVES SPAN CONTINENT AND REACH BRAZIL

Dr. A. H. Taylor of the Navy Research Laboratory, who has been experimenting with transmission, recently spanned the continent with a 54-meter wave. A few days after

O'NEIL AUDIPHONE
LOUD SPEAKER

A Masterpiece
Demand a Competitive demonstration IN YOUR DEALER'S STORE
Will not "Blast" or "Chatter" on Neutrodyne or Super-Heterodyne circuits.

COMPLETE WITH 12" HORN $25.00
COMPLETE WITH 14" HORN.....$28.00
Written Guarantee With Every Speaker
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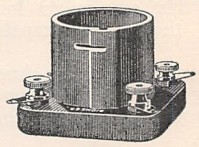

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Give Your Set The Best

There is nothing more important than a good socket. Leaks, poor contact, etc., ruin the best circuit and interfere with good reception.

Pioneer-Socket

Moulded in our factory from genuine Bakelite. It has extremely low losses. The special side contact springs assure clean positive contacts without strain on tube or socket.

Ask your dealer or write us.

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NEW
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EXCHANGED OR REPAIRED
FOR OLD $2.25 All Types

Send any type or make of tube in any condition
199-201A-12-200

We will replace your old Burnt-out or Bad Tube with another of similar type and guarantee it to function as well as any Standard Tube made.

Our Tubes are made in all types—201A, 200, WD-12, WD-11, 199, etc. Any tube that does not oscillate and amplify will be replaced Free of Charge if Filament is not burned out.

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985 Third Avenue New York City

Insure your copy reaching you each month. Subscribe to RADIO NEWS — $2.50 a year. Experimenter Publishing Co., 53 Park Pl., N.Y.C.

this achievement, the head of the Naval radio research work was surprised to get a letter from Rio de Janeiro, stating that his 54-meter transmitter at Bellevue had been heard also in that distant city.

This last report is especially interesting as the distance is 4,780 miles over land and sea, and difficulty has frequently been found in getting radio messages over the part of South America which projects eastward into the Atlantic. The report from the fan in Rio, whose name is Lacombe, stated that at 11 P. M. on July 1st, 3rd, and 5th, he heard the special short wave set from Bellevue, D. C., distinctly.

On the West Coast, it was an amateur by the name of Stanley T. Runyon, operator of station 6AGE, who reported the reception of Dr. Taylor's transmissions on July 14th.

These confirmations that short-wave transmissions are reliable for long distances comes as an inducement to amateurs to try out the lower wave-lengths, especially since the Department of Commerce has just opened several bands for their use below 200 meters. One of the bands includes the wave-length used by the Naval expert.

Dr. Taylor transmits on 54 meters on Monday, Wednesday and Friday nights at 8, 9, 10 and 11, and at half past these hours, on 100 meters, so that all amateurs have an opportunity to test their receivers for the lower wave-lengths.

TRAFFIC SPED UP BY AUTOMATIC TRANSMISSION AND RECEPTION

While the Naval Radio Central at Washington was testing out reception from San Diego, California, with the Creed Automatic Recorder at the rate of 40 words per minute, one of the radiomen on watch also copied the West Coast station with a perfect score. Some of the radio gobs immediately asked what was the use of the automatic recorder? The reply was that this test was only a preliminary one; the Communication Office is planning to run the speed up to 100 words per minute or over, when installations, including relays, are tuned up properly and actual high-speed transmission is practical.

The central office of the Navy is making efforts to speed up its traffic, and hopes eventually to clear all transcontinental matter in an hour or two each day, which can probably be done if the high-speed tests work out satisfactorily.

On June 19th, 10,350 words were transmitted from Radio Central in the Navy Building at Washington in six hours and thirty minutes. This was an average of 28 words per minute and is a record for the office, that is, by manual sending.

On another day, during twenty-four hours the Army and Navy operators in Washington cleared 29,408 words, not counting headings to messages, on three transmitters.

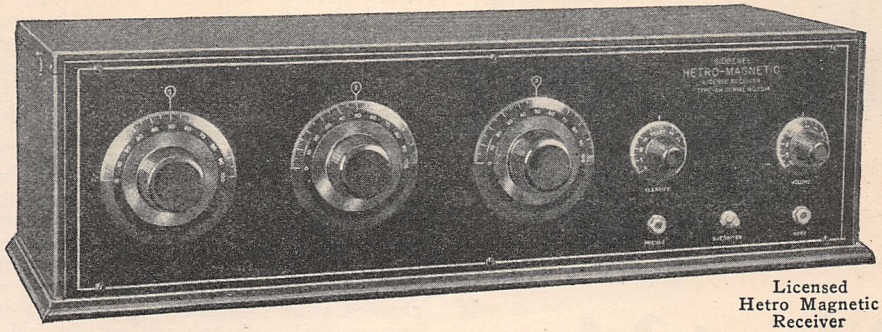
"KILKENNY" HAS EFFICIENT RADIO

The Department of Commerce motor patrol boat *Kilkenny* has just had her radio equipment overhauled and is now ready to carry on long-distance radio communication if necessary. This craft is used by a division of the Bureau of Navigation charged with the inspection of motor boats in Chesapeake Bay. It sees to it that motor boats comply with regulations and policies the Chesapeake and its tributaries. Offending motor boats equipped with radio listen when KKI goes on the air.

Sometimes Secretary Hoover uses this craft, and then its radio set is almost always in constant use, for the Secretary believes in keeping in touch with headquarters and also likes to listen in.

Supervisor R. Y. Cadmus, of the Third

WILL YOU GET LONDON?



Licensed
Hetro Magnetic
Receiver

ANY radio engineer will tell you that Hetro Receivers are not only the most powerful and superior, but get greater distances clearer and louder than any other known type of receiving instrument.

EUROPEAN stations have frequently been heard, but cross continental reception is nothing new to tell of when using Hetro Receivers.

HERE you have a five tube Hetro Receiver, employing the standard three dial tuning system, enabling one to get the same station at all times on the original dial settings, using three stages of Hetro Magnetic frequency, detector and two audio, enables you to get the most distant station on the loud speaker, exceptionally good and clear.

THE fact that less "B" battery current is consumed saves the purchaser much of the out-lay in buying renewal "B" batteries and recharging "A" batteries.

SO clear is the speech that the majority of progressive farmers who depend largely upon agricultural reports, are disbanding already purchased five tube sets for the Hetro Receiver. They are most dependable for reason that location does not interfere in any way with the volume of the signals.

THE set itself is selling for a remarkable low price, making the greatest value radio manufacturers have ever offered. Built in a most beautiful solid mahogany cabinet with a handsomely engraved panel, making the set fit for the most artistic reception room.

Specifications

Circuit: Three stages of tuned Hetro Magnetic frequency amplification and detector, and two stages of audio frequency amplification.

Tubes: Five in all. Automatic five or four tube control.

Wave Lengths: 150 to 610, includes amateurs.

Aerial: Loop or out-door 75 to 100 ft.

Panel: Beautifully engraved, rubberlite or bakelite, high polish.

Dials: Three 4 inch Bakelite.

Rheostats: Standard Klossner.

Condensers: High Frequency—minimum loss.

Sockets: Hoosick, Bakelite.

Cabinet: Mahogany, Distinctive finish 7x26.

Price: Type "H," receiver only, $75.00.

Manufactured under special license, granted August 13, 1924

GUARANTEE—Will replace any defective set within two years.

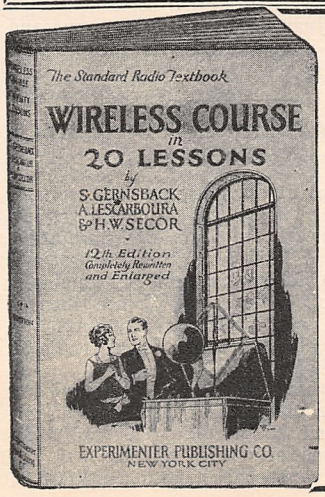
Price

Receiver only type 5 H - - $75.00

Sidbenel Radio Equipment Manufacturing Co.

29 West Mount Eden Avenue
New York, N. Y.

***Manufactured under special license granted August 13, 1924. Dealer inquiries welcome.**



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The Standard Radio Text Book

Size 6 x 9 inches. 264 pages. 500 illustrations. Binding de Luxe. Semi-flexible Leatherette Cover. Genuine Gold Stamped, Round Corners, Red Edges.

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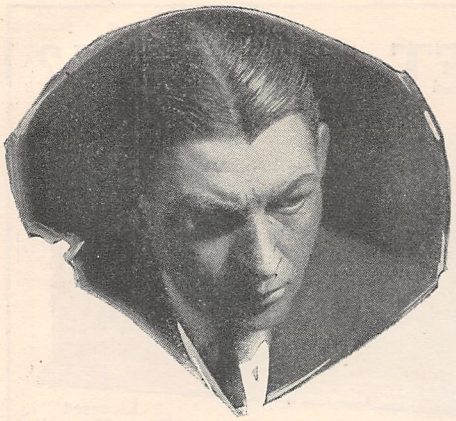

Must Men Fear 40?

MEDICAL authorities agree that 65%, or nearly two-thirds, of all men past middle age, are afflicted with a disorder of the prostate gland. Here is the known cause for many of the ailments commonly ascribed to declining years—including aches in back, feet and legs, frequent nightly risings, sciatic pains, nervousness and lack of vitality. But now, science knows that thousands suffer needlessly.

For a member of the American Association for the Advancement of Science has discovered a remarkable new drugless hygiene that usually restores the prostate gland to its normal functioning. Already it has been used by more than 15,000 men—Doctors, Statesmen, Teachers, Bankers, Lawyers, men in every walk of life—with amazing results.

FREE BOOK

If you will mail the coupon below you will get, in plain wrapper, a free copy of an interesting book describing this new method. It contains facts every man should know. But send immediately, for the edition of this book is limited: address

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Please send me Free, and without obligation, a copy of your booklet, "Why Many Men Are Old at 40." Mail in plain wrapper.

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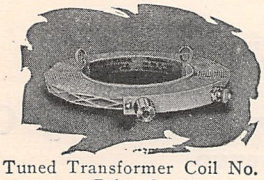

Tuned Transformer Coil No. 14
Price $2.00
Patented Aug. 21, 1923

Hold that Station!

You can get and hold the station you want, and keep out the others, with Sickles Diamond Weave Coils.

Sickles Tuned Transformer Coil No. 14, and the Knockout Reflex Coil No. 8, especially designed for the most popular circuits, make a receiving set remarkably selective.

The No. 14 Tuned Transformer Coil is absolutely self-neutralizing when placed at the proper angle in a set.

Write for particulars.

F. W. Sickles Co.
340 Worthington St.
Springfield, Mass.

SICKLES DIAMOND-WEAVE COILS

Radio District, overhauled the set, aided by Inspector Sterling, and, incidentally, practically made the transmitting and receiving sets over. During the tests he carried on communication by radio telegraph over a thousand miles, getting in touch with stations as far west as Kansas and Minnesota. He also talked with about fifty amateur stations, mostly in the third district, but some distant 200 miles, via radio phone. The *Kilkenny's* set is a 100 watt C.W. set, which can be used for telegraph or telephone work. It operates usually on 300 meters, but can transmit on 200 and 600 meters. She was put in service about fifteen years ago when unlawful operations by oystermen operating motor boats was reported in the Chesapeake. One of her first duties was running down a small craft whose skipper was charged with shanghai-ing. This job was accomplished, although without the aid of radio. Today this fleet craft is the terror of unlicensed craft, most of which are soon run down. Those equipped with radio are said to heave to at once when they hear her call, KKI.

GOVERNMENT MAY PROCEED AGAINST ALLEGED RADIO TRUST

While the Department of Justice officials will say nothing about the plans of the anti-trust division with regard to certain members of the so-called radio trust, it is understood something is in the wind. It had been assumed that the Department would await the completion of the hearings by the Federal Trade Commission of the Radio Corporation, and the other affiliated companies. Now, however, it is believed that briefs relating to price agreements will shortly be filed against certain of the companies. But no official pronouncement has been made public. The Government attorneys may proceed independently of the action of the Federal Trade Commission, which filed complaints against the associated radio interests several months ago.

MINIATURE MODEL OF HIGH POWER NAVY STATION

A model of the Annapolis radio transmitting station built by W. Partridge of the Bureau of Yards and Docks, has been placed on exhibition in the office of Secretary Wilbur of the Navy. The great gridiron antenna held aloft by six 600-foot towers, each 1,000 feet apart is shown in detail, with every wire in place. The lead-in runs to the power and apparatus houses, beside which are the operators' quarters and the transmitting rooms of the radio station.

The Annapolis station has a duplicate 500 KW arc set and transmits on a wave of 17,145 meters.

NSS is used by the Navy for direct communication with San Francisco, San Diego, Balboa, San Juan, London, Paris, Rome and naval vessels in the Mediterranean and European waters.

RADIO, A DEAF BOY'S HOBBY

BY WALLACE R. TURNER

When I was at the unripe age of four, I leaned too far out of the second-story window, and obeyed the laws of gravitation. As a result, I landed on the back of my cranium, knocking my unlucky auditory nerves out of commission. Since then, I haven't been able to hear anything. In spite of this little inconvenience, radio is my greatest hobby.

One day, away back in 1917, I spied a copy of the *Electrical Experimenter* on the newsstand, and bought it. The radio department, especially the pictures of the "Hams'" wireless shacks, with the litter of

12 Cells 24 Volts Solid Rubber Case

$3.50 C.O.D. **SPECIAL**

INTRODUCTORY PRICE

For a limited time *only*, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for $3.50. Regular Retail Price is $5.50. You save $2.00 by ordering NOW. A finer battery cannot be built than the

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To ten million homes with Radio Sets—and to countless millions of prospective buyers—this WORLD Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. *And you save $2.00 by ordering now.*

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Has heavy duty 2 1-8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and seepage of current. It holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static" Mail your order today.

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Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), $13.00. Pay Expressman after examining batteries. 5 per cent discount for cash in full with order. Send your order NOW and save $2.00.

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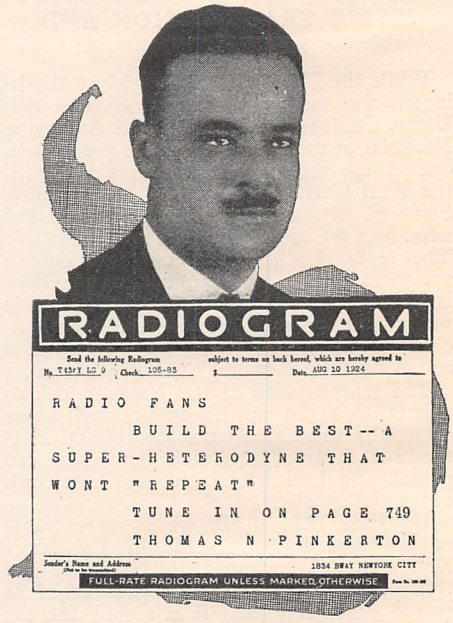

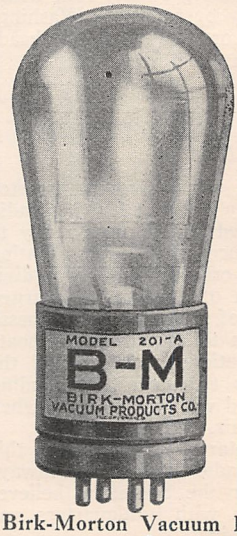

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It is a Better Made Tube.

Detector Amplifier
.25 Amps.
5 Volt
Guaranteed

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Birk-Morton Vacuum Products Co., Inc.
Owensboro, Ky.

ponderous couplers, ceiling-high loading coils, inevitable spark coils and gaps, helices and other miscellaneous contraptions, fascinated me. Then and there the radio bug bit me good and hard. Being a precocious lad of fourteen, I easily succumbed to the infection.

Although I knew that radio was only for those with excellent hearing, I was not worried, for I also knew that there is often a way to circumvent Nature. Couldn't I use a sensitive relay in place of the phones, I argued with myself, and have it work a telegraph code printer? Of course I could, but sensitive relays were, and still are, so expensive and so hard to make that I haven't been able to afford one to this day. Because of this, and because my pocketbook was always only one-half of one per cent full, I was on a fair way to convalescence from radiobugitis, until the epidemic of popular broadcasting swept the country in 1922. This gave me a relapse, which proved worse than the first attack.

Ever since I bought the first copy of the *Electrical Experimenter*, I kept on buying that magazine. In this way I learned the technicalities of radio. I also learned how different sets, batteries, tubes, and phones behaved under varying conditions. Thus, when I built my first set, a crystal affair, in 1922, and subsequently a blooper, a two-tube blooper, reflex sets, and a Neutrodyne, I knew what to expect from them. Each time I finished constructing a set, I had a friend, with normal hearing faculties, but with no previous knowledge of radio, listen in while I did the preliminary tuning. When the friend heard a station he stopped me, then worked the dials until he brought in the station at its maximum. I asked him to tell me exactly how the music or speech sounded. If the set did not seem to work right, or did not work at all, I usually was able to correct the faults myself. The trouble in most cases was due to faulty wiring.

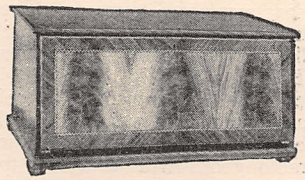
Although I made and sold several sets prior to September of last year, I was unable to secure enough materials to build a set powerful enough to suit my needs, until that time. After completing that set, a three tube reflex (I lived within five miles of several powerful broadcast stations), I found that by placing the receivers in my hands, with the openings in the caps against the palms, I could feel the code, speech, music, and static very clearly. I could not hear, even through the bones, because the auditory nerves were destroyed. The deaf persons who can hear and understand every word over the radio are enabled to do so only because of defective or impaired ear-drums. If the inner ear and the nerves are destroyed, there is no hope, but cheer up, the world isn't such a bad place. Think of those who have to listen to static (and their wives) most of the time. I can sometimes distinguish the musical instruments by feel, because I often placed my hand on different musical instruments in order to get the feel of the vibrations and still remember how they sound. It is a very interesting experience to listen to a whole orchestra over the radio by feeling the vibrations only.

I am unable to understand what is being played and sometimes mistake noises, caused by the receiver itself, for music. I often disconnect the aerial and ground from the set, after I get a station, in order to be sure that the noises are not caused by the receiver.

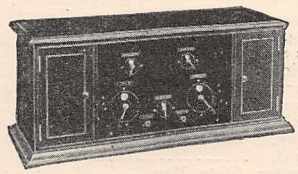
Some day I plan to construct a miniature public-loud-speaking outfit. I shall then have my friends speak into the transmitter, while I listen with the phones (in place of the usual loud speaker), and in this way I hope to be able to understand conversation through my hands, in much the same manner as the blind read Braille writing by the touch method.

You'll be Proud of This Michigan Four

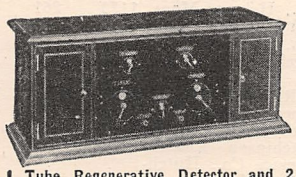
"America's Most Beautiful Set"



Michigan "de Luxe" 4 tube receiver. 1 stage R.F. amplification. Built-in adjustable loud speaker. Solid mahogany case. "America's most beautiful set." M R C4, ...$150



3 tube receiver in handsome case with inlaid panel door, and compartments for batteries, head phones, etc. M R C3, $87.50



1 Tube Regenerative Detector and 2 stages of amplification. The set we never could catch up on orders for last year. M R C12, ...$57.00

THE art of Chippendaie, the grace of Louis XIV, the sturdiness of the Jacobian period have been combined in this wonderful Michigan four cabinet. And in the radio receiving set itself, all the latest development in good construction and design have been incorporated. One stage of radio frequency, a detector, and two stages of amplification, give you distance—selectivity and unusual volume.

A built-in loud speaker, with adjustable feature of exceptional mellow tone quality is part of the set.

Also compartment with ample room for batteries. The set operates equally as well on Standard Six Volt or Dry cell tubes.

The beautiful mahogany cabinet with inlaid drop panel gives you a set that cannot be surpassed for beauty and service.

Write for Illustrated Folder
Ask Your Dealer for Demonstration

Michigan 2 stage amplifier. Will operate any loud speaker. Gives any degree of volume desired without distortion. Can be used with any receiving set. M R C 11. $30.00

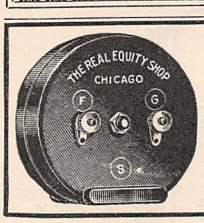
2 tube Regenerative long distance wonder. M R.C.2. $32.50

Other models and types to meet all requirements from $32.50 up.

Licensed under U. S. Patent 1,113,149—letter pending 807,388

MICHIGAN RADIO CORPORATION

34 Pearl Street, Grand Rapids, Michigan



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Long Wave Radio Frequency Transformers matched in sets of Four. The coils in these Transformers are carefully calibrated in our Laboratory. Each set is peaked at a Uniform Wave Length. A Hookup diagram furnished free from which wonderful results are obtained. A complete Hookup consists of:

4 Transformers $30.00 1 Special Choke Coil $3.50 1 Oscillator $1.75

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The Whittlesey System of Aerial Support consists of Self-Supporting Fabricated Steel Masts Shipped in Sections, Mast-Head Pulley, Cable and Hoisting Reel—the painter's "elevator." No Guys, Ladders or Platforms. These masts are solid, stiff, rigid and beautiful. 50-75-100-125 feet. Self-Supporting Broadcasting Masts erected anywhere, any height, any strain required. The Whittlesey Engineering Co., Cleveland, Ohio.

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Each tube guaranteed for 1000 hours

Mail Orders solicited and promptly attended to.
All Types except V.T.-1 and V.T.-2
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LOUD EVERYWHERE. A SIZABLE CHUNK——SENSITIVE ALL OVER. ATTRACTIVELY MOUNTED
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PRICE 50c POSTPAID
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PRICE $1.00 POSTPAID
FIXED DETECTORS-
ARE LOUD AND CLEAR.
NICKEL PLATED
Especially Adapted FOR REFLEX
DURABLE
PAT. APPLIED FOR
3 GOLD CAT WHISKERS--50c
Fine, Medium, Coarse. Any One--25c
RADIO'S BEST GIFT
(For your Romeo or Juliet)
ATOMITE, Set with Gold Cat Whisker in a Nifty Leatherette, Plush lined box.
PRICE $1 00
THE KEYSTONE PRODUCTS CO.
ROYAL OAK. 304 Gardenia Avenue. MICHIGAN

Burns Loud Speaker
Price $22.50
A SPEAKER OF DISTINCTION WITH
Volume, Clarity, Beauty
Designed and built by Experts for over 30 years makers of telephones.
American Electric COMPANY
State & 64th Sts., CHICAGO, U. S. A.

I want to warn all deaf people that before making or purchasing a set, they should listen in to a friend's set or a radio dealer's. They should also listen in to several different receivers until they find the right one, but if they don't, this method will make disappointment less bitter, and save a lot of money besides. Radio is a great game, try it, just for once.

POLAND OPENS RADIO COMMUNICATION

Poland has lifted the ban on radio. Transmitting licenses will soon be issued for broadcasting by scientific, educational and manufacturing organizations and regulations covering reception will probably be similar to those of France, according to advices reaching the Department of Commerce. The new law which went into effect in August will undoubtedly stimulate the development of radio in Poland especially among the general public. The Government will probably adopt measures for the promotion of home industry, but competition with American and German radio goods will continue to be severe.

SEVEN NEW CLASS A STATIONS

Call	Class A Stations	Frequency Keys	Wave Lengths Meters	Power Watts
KFDL	Knight Campbell Music Co., Denver, Colo.	1330	226	5
KFOF	Rohrer Elec. Co., Marshfield, Ore.	1250	240	10
KFQH	Radio Service Company, Burlingame, Calif.	1300	231	50
KFQY	Farmers State Bank, Belden, Nebraska	1100	273	10
KFQZ	Taft Radio Company, Hollywood, Calif.	1250	240	250
KFSY	The Van Blaricon Co., Helena, Mont.	1150	261	10
WEBK	Grand Rapids Radio Co., Grand Rapids Mich.	1150	261	20
	TRANSFERRED FROM CLASS C TO CLASS A			
WBAO	James Milikin University, Decatur, Ill.	1090	275	50
WFAN	Hutchinson Electric Service Co., Hutchinson, Minn.	1050	286	100

DeFOREST COMES INTO HIS OWN AFTER YEARS OF FIGHTING

After years of bitter fighting, Dr. Lee DeForest, inventor of the Audion tube, which makes possible radio broadcasting and receiving, wireless telephony and the talking motion pictures known as the Phonofilm, won a notable victory in the United States District Court.

By an order of the court, *priority of invention was awarded to Dr. Lee DeForest, on the feed back circuit and oscillating*

SPONGE RUBBER
EASY-SEAT
Scientifically prepared for radio use
Absorbs all vibration
New!
Put an Easy-Seat under each corner of your tube or crystal set. These soft, round, sponge rubber pads, beautifully finished with sealed edges, in an attractive green, absorb all vibration and eliminate microphonic noises. This means greater distance, clearer reception, longer life for your tubes and the ability to hold the most delicate adjustment. Insulates and prevents scratching of furniture.
For maximum protection, mount each tube on rough cut Easy-Seats. 2½x3—⅜" thick, 12c each. 2½x3—⅝" thick, 20c each.
At your dealer or write direct. Postage prepaid.
EASY SEAT SALES AGENCY
Jefferson Bldg., Philadelphia
65¢ Set of 4

Jiffy Blow Torch
Good Soldering— Good Reception!
You know how essential good soldering is to the working of your set. A "Jiffy" Blow Torch will give you a real professional job. Self-blowing—absolutely safe! "Jiffy" complete outfit, Copper Soldering Iron, String Solder, "Jiffy" Non-corrosive Flux and "Jiffy" Blow Torch with accessories, $2.50.
At your dealer's or direct
Apex Stamping Company
Dept. 20 Riverdale. Ill.
Dealers! Write for proposition

RADOLENE
"The Liquid Spaghetti"
RADOLENE will put an end to your insulating problems. No more fussing and fuming with old fashioned spaghetti tubing. A touch of the brush after the set is built and the work is done.
RADOLENE has successfully passed high voltage tests; it is a highly efficient insulator. It is flexible. It is applied easily with a brush and dries instantly.
Send 25c direct to us if your dealer cannot supply you. RADOLENE comes in five colors—Red, Yellow, Black, Green, Purple.
JOBBERS AND DEALERS WRITE!
Neumade Products Corp.
249 West 47th Street
N.Y.C.
Look for this box.
25¢ a bottle

MICADENSER
Increased Signals
ACCURATE, constant, unchanging condenser capacity is demanded for greatest possible selectivity, clearness and loudness. Ben Franklin Micadensers, of all-metal and mica construction are individually tested by a special direct reading instrument. Accuracy guaranteed within 10% or your money back.
Made in all standard capacities. Most popular capacities priced as follows:
.0001 . . 35c .001 . . 40c .006 . . .75c
.00025 . . 35c .002 . . 40c .015 . . $1.75
.0005 . . 35c .005 . . 60c
.00025 with Brackets for Grid Leaks . . 45c
.00025 with Self-contained Grid Leak . . 60c
.00025 in Matched pairs, per pair . 95c
(Both condensers warranted exactly same capacity)
We will furnish any *exact capacity value* in Micadensers, or *duplicate the capacity value of any condenser* you send us, at 10c above regular price.
At all good Jobbers and Dealers. If dealer can't supply, Ben Franklin Micadensers will be sent prepaid, on receipt of remittance with order.
The Ben Franklin Radio Manufacturing Co.
2652 Superior Avenue Cleveland, Ohio

audion, thereby establishing for all time the claim of Dr. DeForest as their inventor. The two patents issued to DeForest cover completely the subject matter of the patent issued in 1915 to Major Edwin H. Armstrong.

The issuance of the patents to the DeForest corporation is the first direct result of the decision rendered by the district court in Washington on May 5, which declared that Dr. Lee DeForest was the real inventor of the feed back circuit and oscillating audion, and not Armstrong. This decision was the culmination of years of litigation in which DeForest, Armstrong, Dr. Irving Langmuir and Dr. A. Meissner claimed credit for the invention. Despite the claims of the others, a patent was issued to Armstrong in 1915. This patent was later disposed of to the Westinghouse Electric Co., which has since been manufacturing the appliances under its protection.

Despite this fact, DeForest continued his fight. The first victory came to him in May, when the District Court in Washington handed down a decision declaring that DeForest and not Armstrong or the other claimants, was the inventor. Reviewing the case in detail, the Court held that DeForest's invention dated from August, 1912, antedating the claims of the others by almost a year. Following this decision, the Court ordered that patents issued to the DeForest corporation, which controls DeForest's invention on the feed back circuit and the oscillating audion.

No sooner were the patents issued to DeForest than announcement was made that suit would be entered in the district court, through Darby & Darby, 220 Broadway, New York, attorneys for Dr. DeForest, against the Westinghouse Electric Co. for annulment of the Armstrong patents, and to restrain the company from manufacturing the apparatus in future.

Many millions of dollars are involved by the issuance of these patents to DeForest. It means that in future the feed back circuit and the oscillating audion, manufactured under the Armstrong patent by the Westinghouse company, can be made by that concern no longer, but will be manufactured by the DeForest Radio Telephone & Telegraph Co. and its licensees, the American Telephone & Telegraph Co.

Some idea of the magnitude of this outcome may be gathered when it is taken into consideration that the apparatus covered by the patents just issued to DeForest are indispensable to all radio sets, and all wireless broadcasting transmitter sets. It also covers all Super-Heterodyne and Neutrodyne sets.

In a statement issued by Dr. DeForest, who has won such a signal victory, he said:

"Purely aside from any financial return that may accrue from the issuance of these patents to me, I am most highly gratified for sentimental reasons. For almost a dozen years I have claimed to be the inventor of the feed back circuit and the oscillating audion. It was a bitter blow, indeed, to me to see patents for them granted to another claimant. But never once did I doubt but that justice would eventually be given me. that day is now here. My claims have been proven by the last courts, and I am now in possession of the patents which were withheld from me for so long. It is a splendid victory, and I am very happy at the outcome."

THE GROWTH OF CKAC

Though radio stations come and go, Canada's premier station not only remains constantly in operation, but grows steadily in popularity. When broadcasting was born in the industrial city of Pittsburgh, there were about half a dozen radio amateurs in Montreal, none of whom thought the Canadian

The World's Largest Store is

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No matter what you need for your radio—whether it's a complete set or the smallest part—it can be had from RADIO HEADQUARTERS at prices that save you money.

Our new RADIO Catalog is ready. Your copy is waiting for you; so fill in and mail the coupon below. We would like you to see the many radio bargains that the World's Largest Store has to offer. We don't think there is a store in America that has a more complete line.

We would like to have you see the famous SILVERTONE Neutrodyne, the most perfect radio set yet built. Get all the comfort and enjoyment that a good radio set can deliver. Make sure of your satisfaction. You can do it if you deal with RADIO HEADQUARTERS.

Reduced Prices on Radio Tubes.

Radio tubes—standard equipment—can be had from us at the new low price of $3.65. This is just an example of the values that our RADIO catalog offers. Get your copy. Mail the coupon TODAY.

Mail the coupon TODAY to the store nearest you.

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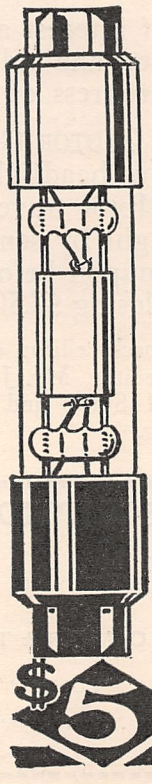
The World's Largest Store owns and operates Broadcasting Station W.L.S. Wavelength 345 Meters. Tune in.



They Roll in On Ball Bearings

The Y.M.C.A. Radio Instructor at Detroit says that with Myers Tubes "the stations roll in on ball bearings"—the long distance stations that cannot be tuned in with ordinary tubes. You can put the world on your dial with

Myers Tubes

Practically Unbreakable

Get England, France, Canada, Cuba, Hawaii, Porto Rico and Japan as others are doing with one, two or three Myers Tubes. They eliminate all noise—function perfectly as Detectors, Amplifiers and Oscillators—increase the radius of your set 50%. Two types: Dry Battery and Universal for storage batteries. (4 volts)

Demand Myers Tubes at your dealers or send price and be supplied postpaid. See "Made in Canada" on each tube. Others not guaranteed.

Complete with clips. No extra equipment required.

$5

F. B. Myers Co. Ltd.
Radio Vacuum Tubes
240 CRAIG STREET, W.
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FOR YOUR SUBSCRIPTION R.N.-11

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Enclosed find $2.50 for my subscription for one year to MOTOR CAMPER & TOURIST.

Name .....

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metropolis capable of falling into line with the big cities across the border, in this very latest invention.

Newspapers carried items about the conversations and entertainment heard from short distances; but none gave much consideration to the future of radio. Local radio companies, with primitive stations, emitted more or less comprehensive syllables and played phonograph records.

The Montreal newspapers remained uninterested, especially the French publications, owing to the lack of direct interest radio brought to their readers, unfamiliar with the English language.

THE BIRTH OF RADIO IN CANADA

One day, however, in April, 1922, Canada's largest daily, and one of the most important French publications in the world, *La Presse*, came out with a front page article, stating that a contract had been signed with the Marconi Company for the erection of a 500-watt transmitting radiophone station. The French were jubilant and the local radio business took a 100 per cent. jump, with the prospect of this new station of their own.

Engineers were immediately put to work, towers were erected and a spacious studio built on the roof of the *La Presse* building, and trials were made during the next four months. The official opening of regular scheduled entertainment took place September 30th, when Mary Pickford and Douglas Fairbanks faced the microphone for the first time. They startled their audience by addressing them in perfect French, acquired on Parisian boulevards.

Although eighty per cent. of the population of the Province of Quebec is of French origin, and speaks French almost exclusively, *La Presse*, realizing that theirs was the only station of any importance in the Canadian metropolis, made it a bilingual station. All announcements are given in French and English, and, whenever possible, bilingual talks and songs. A noteworthy example of broadmindedness.

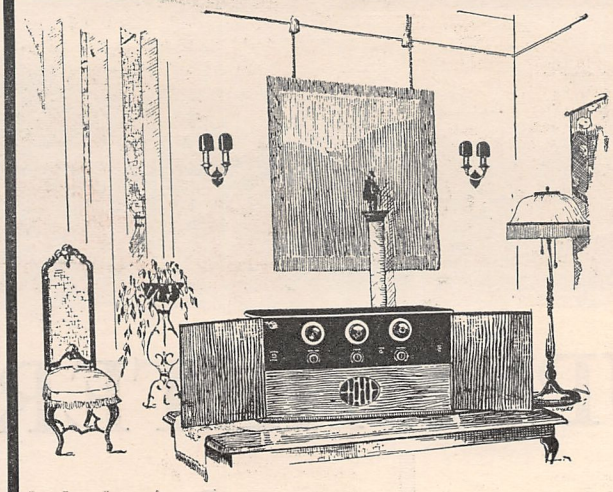
The success of the station was instantaneous and congratulations poured in from all parts of the country. CKAC became one of the most active of the radio public entertainers from that date, and since has carried on improvements by many other cities. The winter of 1922 witnessed the increase of power to 1,000 watts, and an all Canadian-made set was used. In the fall of 1923, an extra 1,000 watts were added, with the result that CKAC was heard, favorable conditions prevailing, in Alaska, in Denmark, France, Italy, England, and other European lands.

The files of CKAC show letters from every state in the Union and Province in the Dominion, all bearing testimony to the good management and efficiency of the station and its value as an educational medium. Many thousands of English fans request a French course, which may be given after the Ilo course, as Ilo is a great aid in the study of both Romance and Germanic languages. The French of the Province of Quebec and of the New England States have expressed their thanks to the station for its bilingual service, a valuable help to them in acquiring a working knowledge of the English language.

CKAC is the only French station on the North American continent and the only French and English station in the world. It caters especially to some five millions of French, scattered throughout the various provinces of the Dominion, several states of the Union, the small Island of St. Pierre Miquelon and in the West Indies and the Guianas.

THE NEW CKAC SET

To reach these French people with greater regularity, whether in static belts or dead



Newport Radio Receiver

You can recommend this receiver to your friends

The Newport Radio Receiver is a tried and proved receiver. You can show it to your friends without apology.

The Newport Radio Receiver combines the four prime elements of radio: Quality, Selectivity, Volume and Range without sacrificing any one of them. It is sturdily constructed of the best materials and, with ordinary care, it will give many years of satisfactory service. It has been subjected to the most trying tests; it has been tested and approved by leading authorities in the industry. It operates at less by 30% A & B battery than the average receiver. It will not squeal.

Each Newport Radio Receiver is equipped with an unlimited guarantee for one year and a complete and comprehensive booklet on its operation.

The Newport Radio Receiver is built in cabinets of three designs—designs that delight all lovers of fine furniture. It is the receiver you want in your home. This model $155. ($160 West of Denver.)

It is equipped with two things; an unlimited guarantee for one year and a complete booklet of instructions.

* * *

It is inexpensive to operate (at least 30 per cent less A & B battery than the average set).

* * *

It will not squeal.

* * *

Its sturdy construction, coupled with the careful selection of the best materials, insures many years of satisfactory service.

* *

It is a good Receiver built in a cabinet that delights lovers of fine furniture.

* * *

It combines the four prime elements of Radio: Quality, Selectivity, Volume and Range.

* * *

It has been approved by leading authorities in the industry.

* * *

It has been designed and built by competent engineers.

* * *

It is the receiver you will want in your home.

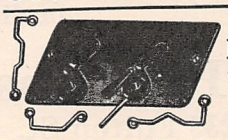
Please address:
R. N. Campbell

The Newport is a good receiver built in a piece of fine furniture

Newport Radio Corp.

250 West 54th Street, New York City

Use "RAGEMCO" Tools to Build Better Radio Sets



ER-203 WIRE BENDING TOOL

For making eyes, loops, bends, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Full directions in box. Made of heavy steel, blued and finished.

ER-203—Price $1.00

ER-703 TOOL CHEST

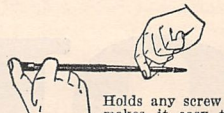
Set consists of "LOCK-GRIP" master handle, 5" long, black Rubberoid finish with steel chuck, nickel plated, buffed and with the following 9 tools: Saw, bradawl, large screwdriver, file, scratch awl, gimlet, reamer, chisel, small screwdriver. Each tool of fine steel, drop forged, tempered, hardened, and nicely finished. Set comes in leatheroid box with tray.

ER-703—Price $1.85

ER-303 HAND DRILL

The hardwood handle is hollow to store drills. Iron frame, nickeled parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3/16. Length of drill, 12 inches.

ER-303—Price $2.25



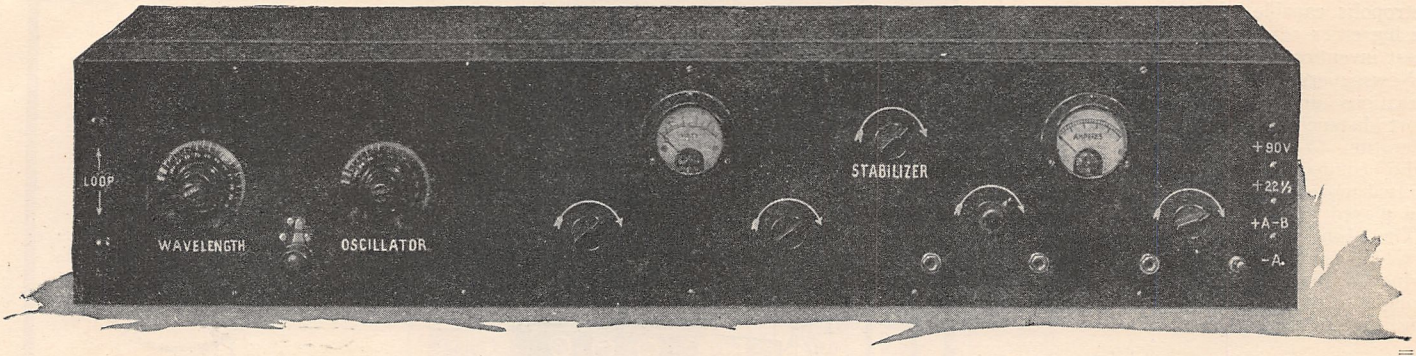
ER-304 SCREW STARTER and DRIVER

Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Constructor. All parts heavily nickeled and polished.

ER-304—Price $1.00

ORDER BY ORDER NUMBER

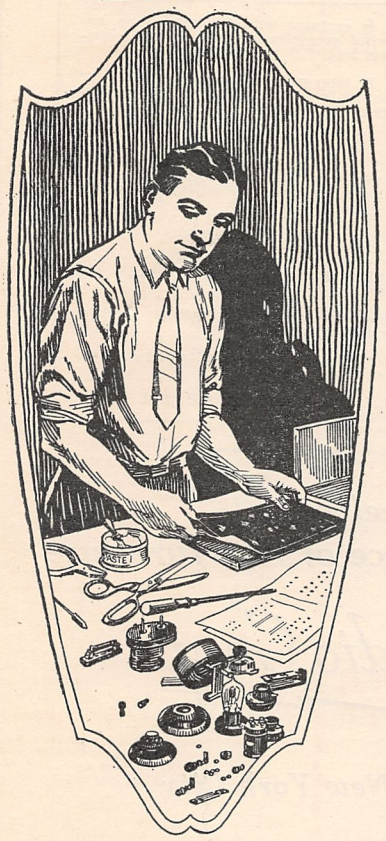
THE RADIOGEM CORP., - - - - 66-R-W. Broadway, New York City



This SUPER-HETERODYNE

PATTERN

$1.00 PREPAID



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Consrad Method

As illustrated above, "Consrad" patterns are the simplest ever originated. You have blueprints, full size, and an instruction book to follow. You cannot go wrong. Write for our full list of publications on reflex, crystal and tube hookups.

Perfectly balanced. High Wave Length Conversion action giving maximum amplification. Only two tuning dials with stabilizer. Splendid natural tone quality.

Build it Yourself with this

Super Pattern

The simplest, greatest and most revolutionary Radio Pattern ever designed. The complete super-heterodyne as shown above can be built with this pattern by anyone.

The secret of the marvelous simplicity is the gigantic blueprints that are drawn the full size of the super-heterodyne itself. The blueprint of the *wiring diagram* measuring 19½" x 44" is drawn by a master radio engineer, every conceivable measurement is given right on the pattern so that you need not measure a single wire.

The blueprint of the *panel layout* is made up so that all you need to do is to lay it flat on the panel and then take a pencil and carefully trace each hole as shown because the blueprint measuring 19½" x 44" is the exact size of the panel required.

Then extra comes a 16 page booklet, size 8" x 12", the most complete booklet of this kind ever made up. It describes every little detail, shows you how to proceed in building. What parts are necessary, how to set them up and lastly how to operate them.

The price of the complete pattern, comprising two blueprints, size 19½" x 44" and a 16 page booklet size 8" x 12" and enclosed in an extra heavy cardboard box printed handsomely in two colors is only $1.00.

Here is the most wonderful opportunity for every radio amateur to have the finest set yet designed for radio receiving.

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or direct from us

The Consrad Company

233 Fulton St. New York City

Consrad

RADIO'S FOREMOST PUBLISHERS — Everything in Books, Patterns and Diagrams

zones, CKAC is now adding an extra 5,000 watts, so that its golden tones of good will can reach all anxious to hear radio in their native tongue; and incidentally show Europe that two entirely different races can truly give their mutual praises in either language, and wind up the evening singing the Empire's National Anthem.

The new CKAC apparatus was manufactured by the Canadian Marconi Company, Montreal. No less than fourteen tubes of the Mullard type, each of 2,000 watts, are used: one power amplifier, three oscillators, four modulators and six rectifiers. A feature of this new set is that the energy, before going to the modulators, is treated to three-phase double-wave rectification by means of the six tubes mentioned. The ordinary commercial lighting energy being used to operate the transmitter, no motor-generator is required, and rectification ensures absolute clarity and tone-purity in broadcasting.

Besides, no carrier-wave noise or generator hum of any kind can cause distortion or interfere with the faithful reproduction of voice and music, whether transmitted direct from the beautifully finished studio of *La Presse*, or brought in, through remote control, from various points—from the biggest hotel in the British Empire, the Mount Royal, from a church—from a brewery—the entertainment is second to none on the American continent.

AERIAL ENERGY—25 AMPERES

The six rectifying tubes are mounted on a separate panel and are operated by remote control. This unit is located two floors below the operating room. Before the converted sound energy from the magnetic type microphones gets near the actual transmitting apparatus, it is treated to five stages of voltage amplification and, also, power amplification.

After passing through this amplifying apparatus, it goes into the transmitting power amplifiers, whence it is fed through modulators and three oscillators and then into the aerial. The rating of the aerial energy is approximately 25 amperes.

ONLY ONE OPERATOR REQUIRED

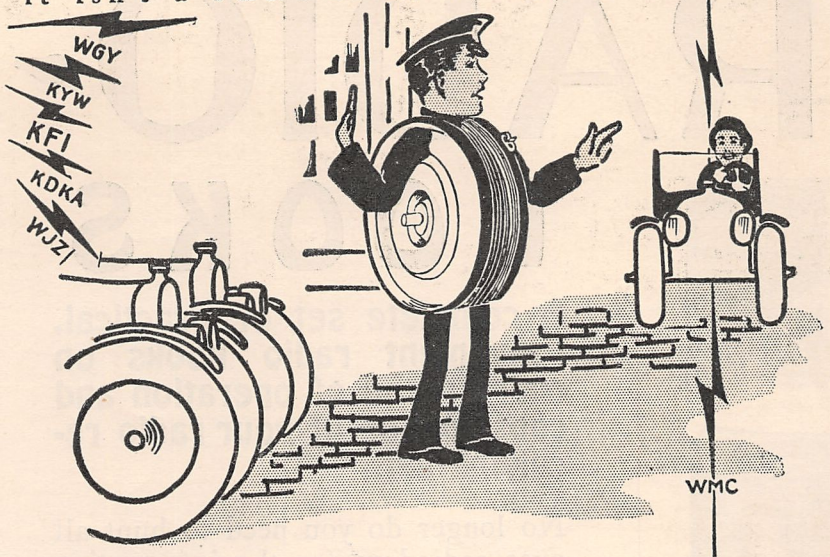
The set operates on choke control and is extremely simple to manage. In spite of its fourteen tubes, one operator only is required to keep the set functioning, after it has been brought into action by the pushing of a single switch. With this new set in operation, it is believed that there will be practically no limit to the distance which CKAC will reach.

U. S. INTERESTS TO DEVELOP NATIONAL COMMUNICATION POLICY

Whether or not the United States takes an official part in the international telegraph and radio conference in Paris next spring, private communication interests in this country are considering the organization of a communication committee. This body is being formed by representatives of the radio, cable telegraph and telephone companies operating in the United States in the interest of an efficient American communication system. It plans to co-operate with the Government, probably through the State and Commerce Departments, by furnishing data and technical advice in preparation for future international conferences on communications.

It is understood that the Radio Corporation of America, the American Telephone and Telegraph Co., Western Union, Postal All American Cables, Tropical Radiotelegraph Co., and Independent Wireless Telegraph Co., are among the American communication companies which will soon appoint representatives on the private communications committee.

If it isn't a FERBEND, it isn't a WAVE TRAP

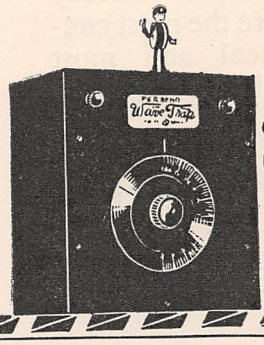


The Traffic Cop of the Air

He arranges in orderly fashion the mass and jumble of broadcasting stations that are seeking entrance to your set, and brings 'em in, one at a time, so you can enjoy them! *Never reduces, but nearly always increases volume.* Add a Ferbend Wave Trap to your set and "police" your reception. Regulate the traffic!

Make *every* night silent night! Trap out the interference. Why pay $50.00 to $200.00 extra for increased selectivity, when for $8:50 you can get a genuine Ferbend Wave Trap which will *absolutely cut out* any interfering station, *no matter how loud, how close by or how troublesome.*

Guaranteed to tune out any interfering station. The Ferbend Wave Trap is designed and manufactured complete by us, after years of careful experimenting. It is not to be confused with imitations, hastily assembled from ordinary parts. The price is $8.50. Shipment is made parcel post C.O.D., plus a few cents postage. If you prefer, you can send cash in full with order, and we will ship postage prepaid. Clip and mail the COUPON today!



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Always look for this Trade Mark. It is your protection against misleading imitations and those who infringe on the registered name "Wave Trap" and its reputation.

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☐ WAVE TRAP. Send C.O.D. I will pay Postman $8.50, plus few cents postage, when it arrives.
☐ FREE BOOKLET on Interference.

Name .....
Address .....
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GUARANTEED LIKE NEW

Burned out filament or broken bulb—send the tube in to us. We return it to you good as new — and guaranteed against defective workmanship same as new tube. New glass bulb in every instance makes sure of proper vacuum and proper "Hardness" for type of tube. Tubes returned parcel post C.O.D. Send yours in TODAY.

$2

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Above Set Wired	7.50
Cockaday One Tube Set—Parts	8.45
Above Set Wired	12.95
All Tubes Repaired	2.00

Remittance must include postage. No C. O. D.

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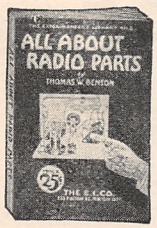

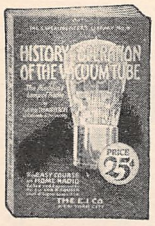

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Tips for the Radio Amateur Constructor
How to Make Practical Radio Receiving Sets
Radio Questions Answered
Radio Frequency Amplification
Loud Talkers, How to Build Them
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One Hundred Radio Hookups
All About Radio Parts
History and Operation of the Vacuum Tube
The Neutrodyne—All About It
How Radio Is Received
How to Locate Troubles in Your Radio Set
Reflex Radio Receivers

To date the U. S. Government has not ratified the conventions of the International Telegraph Union formed in 1908, and as a consequence has not been invited to the next convention. On the other hand, practically all private radio, cable and telegraph companies of the States have been asked to communicate suggestions and recommendations for revising the present regulations of this Union, when the next session is held in Paris, probably in April or May, 1925. This they may do through the inter-company committee being organized, in the event the United States does not participate officially or through unofficial observers. In revising international regulations on communications, it would be absurd to suppose that the United States as a country could be left out. If official delegates are not sent, private representatives will be. The voice of North America is essential in revising universal communication regulations.

When the original international convention was drawn up in 1908, radio was, literally, in its infancy, and the only provisions pertaining to radio operation were for ship to shore service; now, however, radio is as much a part of world communications as is cable and telegraph work, which necessitates the rewriting of the conventions.

In view of the fact that the U. S. Delegates to the recent Mexican Conference encountered a lack of interest on the part of the Latin American representatives to proposals designed to provide better service for the peoples of the Americas and for the development of privately owned commercial systems, the formation of a national commmittee by the North American operating companies seems to promise valuable assistance to the Federal Government in its efforts to promote efficiency on international communication.

The policy of the United States for many years has been definitely opposed to government control or ownership of any communication system where it was possible to have facilities provided and operated by private interests. Following the action of the other American republics at Mexico City aiming at Government control, the State Department here explained that the U. S. delegates found it impossible to co-operate with the Southern governments, and withdrew. The tendency in both Central and South America points unmistakably toward government control and operation of radio, cables, telegraph and telephone systems. So the United States must face the probability of playing a lone hand in any future electrical communication conference in this hemisphere or abroad.

The proposal recently advanced in Europe for an early international conference on this subject makes preparations on the part of this country necessary. Whole-hearted co-operation between the Government and the communication interests will be of prime interest when it comes to laying the cards on the conference table abroad, but indications show that this co-operation will be forthcoming.

Some co-operation abroad for private communication operation may be found. During the last three years there has been evidenced in western Europe a tendency toward entrusting the operation of commercial systems, particularly telephone and radio circuits, to private interests. This is not true in England, however. And unless there is a very decided change on the part of other European Governments from their attitude in previous conferences, the growth of private ownership of communication systems in Europe will not affect the policies heretofore advanced by members of the International Telegraph Union, under whose auspices these conferences are held.

While no announcement has been made by the Administration of this country of its

intentions in regard to the proposed Paris conference or its representatives on any of the committees appointed to study the problems arising therefrom, it seems likely that the experts and technical attaches who attended the Mexican conference will continue to work in preparation for any international parley which may be held.

CONFERENCE MAY DESIGNATE BROADCAST MATTER

Is everything suitable for broadcasting? Should there be any censorship over material put on the air by private broadcasters? These are questions which are very likely to be raised at the Third National Radio Conference soon to be held in Washington.

Secretary Hoover has announced himself as against any form of censorship, and yet as the Governmental administrator of radio, he is apt to be called upon to decide such questions, when complaints come from listeners-in who disapprove of some sorts of entertainment, the acknowledgment of telegrams, "blue" jokes, and expressions of opinion subject to criticism.

For example: What could be done with an individual who continually cursed and swore in the course of a speech he was making or who chose to interrupt the broadcasting of a sermon with impertinent remarks and possibly obscene ejaculations from his own transmitter?

These things have occurred and may be repeated unless some law can be unearthed or created to prevent such practice. Under present radio laws, it is doubtful if the offender could be handled with anything like justice to the incensed fans or the clergyman who was interrupted.

There is apparently no law against saying what one pleases on the air. Radio regulations, which were originally promulgated for commercial and amateur radio telegraph transmission, provide that: "No person shall transmit or make a signal containing profane or obscene words or language." It is understood pretty generally that "transmit" applies to voice transmissions by a radio phone, but it would probably require a court decision to settle this point satisfactorily. It is hoped that the broadcasters themselves will voluntarily agree to abide by the telegraph rules as interpreted by the Commerce Department.

Most broadcasters like to acknowledge congratulatory telegrams, which in general has been banned, being considered private, point-to-point service and not strictly broadcasting. But the question of weather a station is not entitled to do this is sure to be asked at the Conference. Some advocate the granting of at least a few minutes during an evening's program to acknowledgements addressed to individuals. Others say this would become a bore to 999 out of a thousand listeners, unless there was some news in it, such as thanking the fan the greatest distance from the station who reported, or acknowledging the first telegram received following a certain number. Such a practice would certainly be unfortunate unless limited to a few messages. Broadcasters would lose their audiences if it was continued for any length of time.

The last radio conference agreed to refrain from broadcasting advertisements and it is believed further regulations, thought desirable by a majority conference vote, can be enforced by a voluntary agreement to keep the air clean and free from objectionable matter, without any form of Governmental censorship.

PLENTY OF GOOD BROADCASTERS IN PROSPECT

There are twenty new Class B stations now under construction in different parts of the country according to the records of the

FARAWAY GETS STATIONS FAR AND NEAR—LOUD AND CLEAR

AMAZING RADIO VALUES
AT NEW LOW PRICE LEVELS
hear the PRESIDENTIAL campaign speeches by radio

With a beautiful Faraway Radio Set in your home you are always assured of a choice seat for that Opera in New York—the Symphony in Los Angeles—for the latest jazz music and market reports from Chicago—entertainment of all kinds from Havana, Dallas, Kansas City and hundreds of other stations.

Users tell us they have no trouble in getting from 15 to 35 stations in a single evening—far and near—loud and clear as a bell.

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Faraway sets are easily tuned, extremely simple to operate and always dependable. Operate either with dry cells or storage battery. The latest improved type of set construction used only on high priced sets is employed. SATISFACTION GUARANTEED.

Faraway Cabinets are ornamental and massive—beautifully done in mahogany. The panel is finished in dull platinum with all callibrations finely etched in black.

MODEL R
2 tube set sells for only..... **$29.50**

MODEL F
4 tube set shown in illustration for use with loud speaker..... **$59.50**

Faraway Users Endorse It

Hundreds of unsolicited testimonials endorse Faraway. Mr. Stover got over 200 stations—37 in one night. Frank Collins got 150 stations—21 in one evening.

Why Pay $75 to $150 for a Radio Set

You'll actually be amazed when you see these magnificent long distance sets priced so ridiculously low. You'll wonder how we can do it. Our unique selling plan is the answer and we advise you not to buy your radio set until you get it.

There's a *big surprise* awaiting everyone who writes for our selling literature and money-saving proposition. Mail the coupon TODAY.

Dealers—Agents

Our Faraway proposition offers tremendous possibilities for you. Write quickly for plan and territory.

The Faraway Radio Co.
***651* W. Third St., Cincinnati, O.**

MAIL THIS COUPON

THE FARAWAY RADIO CO.,
Cincinnati, Ohio.
Gentlemen:
Without obligation send me:
[ ] Your literature and details of money-saving proposition.
[ ] Agents' Proposition.
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Name .....
Address .....
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All styles DeForest
UV-200, C-300 .....$2.25

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Discounts in quanaities of six or more. May be had in assorted styles. We pay the postage.

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Genuine Bakelite Panels, 3-16 in. per sq. inch	$ .02
$ 2.00 Fil-KO-Stat	$ 1.65
$1.50 Lavite Resistances, 12,000 to 100,000 ohms, ea.	$1.25
$5.00 Acme Radio & Audio freq. Transformers, pr.	$3.95
$12.50 Como Push & Pull Transformers	$ 9.90
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Cannon-Ball Headset

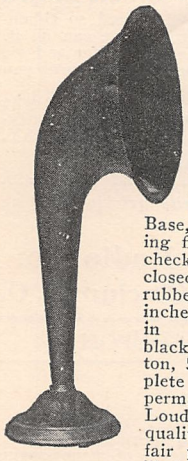
$3.50

Cannon-Ball is the Headset that is giving radio enthusiasts the service they desire. It is made by Camco craftsmen who have been making headsets for over eight years—craftsmen who specialize on headsets and loud speakers.

Examine Cannon-Ball. The careful workmanship and beautiful finish of the entire set will impress you. Slip the phones on your ears. Comfortable? You bet—weighs only ten ounces complete with headband and cord. And when you attach Cannon-Ball to your radio set, the clearness of the reproduction of all tones will please you. "Radio as you like it," will be your comment when you invite a friend to "listen in."

We know that radio enthusiasts are recommending Cannon-Ball Headsets to their friends. To us it means larger production. And to you it means a quality headset at a fair price.

Like other folks, you'll invest your money wisely—Camco Cannon-Ball, $3.50; Camco Grand, $4.75, and the



CAMCO

Loud Speaker

$9.50

Truly a friend of the family. Horn, one piece brown molded fibre; Base, ornamental casting finished with black checked varnish, enclosed bottom, soft rubber feet; Height, 22 inches; Bell, 10 inches in diameter; Cord, black mercerized cotton, 5 feet long. Complete with a Camco permanent adjustment Loud Speaker unit. A quality speaker at a fair price $9.50
West of Rockies.....$10.50

DEALERS: Ask your jobber about Camco products or write for complete details. All Camco products are backed by a liberal, money-back guarantee.

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Big Savings

Standard Parts of Quality

Save big money on standard parts and complete sets. First quality and prompt service guaranteed. Send for free catalog today.

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GREAT LAKES RADIO CO
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Radio Callog

WHAT'S YOUR SCORE?
The New Popular Radio Game
including log, stations, map, score sheets and instructions. 35c, 4 for $1. Money back if not delighted. Wonderful opportunity for agents. Write now!
Radio Callog, Dept. 16, 918 Garrick Bldg., Chicago

Commerce Department, and the erection of about twenty-five more is under consideration. Not all these high-powered broadcasters are new literally, some of them are applying for transfers from classes A and C.

The problem for the Bureau of Navigation Radio Section is not decreased by this fact, however. Somehow a dozen new wave-lengths will have to be found. In general each of the 56 Class B stations has an exclusive wave-length so as to insure no interference from other broadcasters within a very wide territory. Originally there were 50 separate wave-lengths assigned to B stations, but before long some of the stations on opposite coasts or in the same cities, had to share wave-lengths or time. Later a few were given experimental broadcasters and now the band is exhausted.

How to find a number of exclusive wave-lengths for these newcomers is a problem that will probably have to be referred to the National Radio Conference called Sept. 30. It is rumored that some of the higher wave-lengths allocated to amateurs, before the new short wave-lengths were opened to them, may be reassigned to Class A broadcasters, while some of their waves will be transferred to Class B. In all probability the Class C wave of 360 meters, which was the original broadcasting wave, will also be revoked and given to two or three B stations.

The 360 meter wave-length is now used by only 89 Class C stations, all of which it is believed will soon have to transfer to Classes A and B or quit. There is also a possibility of securing a few more wave-lengths, suitable for the use of B broadcasters, from bands in the possession of the Government stations, if the conference should so decide.

ANOTHER WORLD'S LONG DISTANCE RECORD

Coincident with the return of the MacMillan North Pole Exploration Expedition to this country, comes the startling news from Australia that MacMillan's radio equipment has broken all records for 200-meter wave long distance transmission. Amateurs with low power transmitters have worked across the Atlantic and have covered great distances in experimental work but it has remained for the little MacMillan transmitter to outdistance the best of these.

Because of the extremely small space available on the MacMillan ship, the *Bowdoin*, only an extremely low power transmitter of but 100-watt capacity could be installed. In its initial test in the laboratories of the Zenith Radio Corporation of Chicago where it was built, the set gave promise of remarkable performance and through the long year during which MacMillan was frozen in within 11 degrees of the North Pole, communication was maintained with stations all over the United States and Canada and this was deemed excellent performance.

However, little did MacMillan's operator, Donald Mix, realize how far his signals were carrying, when on the 19th of May, at 4:30 P. M., operator W. Cottrell of Coogee, Australia, heard WMP, MacMillan's call letters, distinctly communicating with 6XAD the experimental station of Major Lawrence Mott, located at Avalon on the Catalina Islands. There is no question as to the authenticity of the record as the Australian amateur heard the signals sufficiently well to enable him to identify the peculiar 500-cycle self-rectified note, characteristic of the peculiar and unusual type of transmitter with which the MacMillan Expedition was equipped.

When it is noted that the distance between the location of the MacMillan Expedition in May and Coogee, Australia, is over 9060 miles air line on the great circle, it will be

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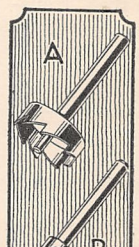
You'll never be troubled with leaky connections when Stevens Spintite Wrenches are on the job. These handy little tools spin the nuts down tight, with vise-like pressure, making joints that are as solid as if soldered. No chance of losing the most delicate impulses.

No fumbling and fussing, with Spintites—they get into the cramped places where pliers are useless. Spintites are **real** tools, made of tempered steel, in one piece; ruggedly built for long wear.

Set of Spintites for Round Nuts, in 3 most popular sizes $1.00
Set of Spintites for Hex Nuts, in 3 most popular sizes $1.00
Set of Spintites in 7 sizes for all Hex Nuts on stand $3.50

Spintites are made in every size and style.



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Stevens Combined Drill and Countersink (see B). Drills and countersinks in one operation. Price 35c.

Write us for Booklet 24, today, describing complete line of radio tools. If your dealer can't supply Stevens tools send his name, and order from us direct.

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Stevens SPEED UP Tools
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Increases signal strength. Occupies only 1 x 3 inches. Gives high capacity and low loss. Vast improvement over large metal plates. Every user delighted with increased efficiency.

PRICE $1 Postpaid

Sold on an *absolute money back guarantee.* If it does not improve your set send it back and get your money. Write for descriptive folder.

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Use Kellogg Noiseless Trans-B-former for your B Battery supply.
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CHICAGO, ILLINOIS

appreciated just how remarkable such a performance really is. Commercial stations with their tremendous power and long waves, have difficulty in covering such distances. On May 19th, the *Bowdoin* was in 24 hours of continuous daylight and at the time reception was reported at Coogee, Australia, WMP was as loud as some of their commercial stations.

It will be noted that operator Cottrell reports these signals at 4:30 P. M. his time, at which time of course he was in daylight and as mentioned before, the MacMillan Expedition was also in daylight. This feature lends added drama to the achievement as it is well known that radio transmission during daylight is very considerably less than at night.

Captain MacMillan can well be proud, not only of the results of his expedition from the standpoint of exploration in the frozen north, but also from the standpoint of pioneering and exploration in the marvelous field of radio. His record of long distance summer daylight radio transmission with low power should stand for a long time.

AMERICA INCREASING IN RADIO EXPORTS FIELD WITH THE OPENING OF NEW MARKETS.

The United States still leads in the exportation of radio apparatus, and is likely to continue in this position despite restrictions in foreign markets and lack of broadcasting facilities in many countries. Annual exports for 1925 will probably exceed five million dollars in value.

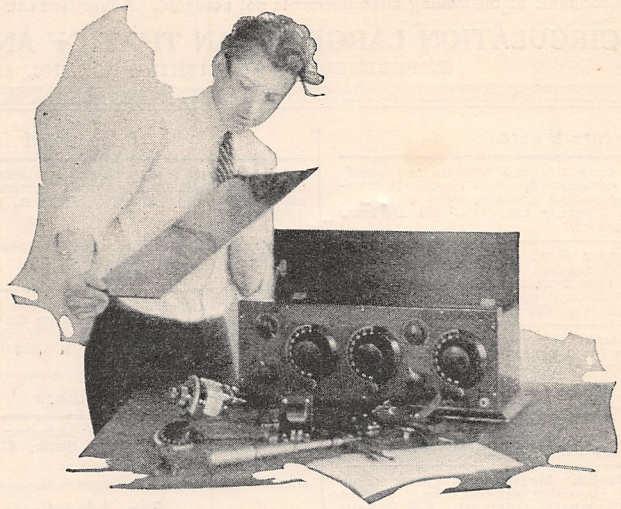
Three years ago there were not more than a dozen manufacturers of radio apparatus in this country—the only demands were for commercial telegraph equipment, whereas today a conservative estimate of the number engaged in this growing industry is placed at 325 firms exporting apparatus for commercial interests, amateurs, and the listening public.

An idea of the immensity of our export radio business may be gained from the fact that during the past seven months radio exports totaled $2,123,832, compared with $1,894,823. during the same period last year, showing an increase of over a quarter of a million dollars. Since January 1, the average monthly value of radio exports has been well over $300,000., against an average of approximately $270,000. last year. All of which goes to show that radio apparatus shipped out of the country annually is a four million dollar business.

Exporters from the States show a steady growth in business and it is stated by government statisticians that our manufacturers can always compete abroad on a quality basis. Of course in countries where there are restrictions against foreign apparatus, a serious handicap is encountered, but these market restrictions are being lifted gradually. Australia has just opened her ports to competition, so has South Africa, while Poland appears to be inclined to accept American goods. Another difficulty is the fact that some governments levy a "listening-in" tax, which reduces the number of fans. In South Africa this fee amounts to about $10.00 a year, and in Australia almost as much is charged for the privilege of operating a first-class receiving set.

In spite of these difficulties in the way of foreign competition, radio exports from the United States have increased steadily month by month this year over the same period last year, with one exception. During July last year, $443,000 worth of orders went to Sweden, bringing exports to $682,885, while the figure for this July is 43 per cent. of it.

Buy a
Fibroc-Bakelite Panel



If you want to be sure of

—efficiency

Because of its high dielectric strength FIBROC-Bakelite panels insure freedom from distortion. They will not absorb moisture.

—strength

FIBROC has a tensile strength of from 10,000 to 25,000 pounds to the square inch. Though lighter than aluminum it is stronger than steel of equal weight.

—beauty

FIBROC-Bakelite Panels are made in black or mahogany finish and with either a high lustrous polish or velvet finish, that adds real beauty to the set of which it is a part.

—ease of working

FIBROC-Bakelite Panels can be punched, drilled or cut without chipping or feathering and may be machined in any direction. They are readily engraved. They will not warp or cold flow.

FIBROC-Bakelite Panels are sold by good radio dealers, in standard sizes, each packed in a separate envelope. Ask for them by name.

FIBROC INSULATION COMPANY

353 Lincoln Avenue **Valparaiso, Ind.**

ONE THOUSAND AGENTS WANTED

WE want one thousand agents to sell subscriptions to RADIO NEWS, SCIENCE & INVENTION, THE EXPERIMENTER and MOTOR CAMPER & TOURIST. We will pay a generous commission for this work and help you in every way. Our four publications are leaders in their fields, ready sellers and this is an offer well worth your while. A few spare hours a day will bring you a handsome return. Write regarding our proposition at once and be the first one to get started in your vicinity.

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Follow these advertisements every month. Reliable advertisers from all over the country offer their most attractive specials in these columns.

Classified advertising rate twenty-two cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the January issue must not reach us later than Nov. 1st.

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Agents Wanted in every city and town to sell standard radio apparatus. Attractive discounts given. If interested write us at once stating age and radio experience. Wilmington Electrical Specialty Co., Inc., 405 Delaware Ave., Wilmington, Delaware.

General Agents—Service Men! Genuine Gold Letters for store windows easily applied. 20 per cent cash commission on all orders from local agents appointed by you anywhere. 50 per cent discount on your own orders. Free samples. Metallic Letter Co., 422 N. Clark St., Chicago.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

Big Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50; make $1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 133, East Orange, N. J.

District Managers Wanted. Appoint Local Agents for us in your locality. No canvassing or delivering. $100.00 weekly easily made. Commissions advanced. Bob Russell, Y 2307 Archer, Chicago, Ill.

Big Money and Fast Sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 27, Newark, N. J.

Agents Wanted—Sell four tube radio receiver at $45.00. Pleasant work, big profit. Write for our proposition. Imperial Radio Company, Binghamton, N. Y.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refinishing auto headlights, tableware plating. Outfit furnished. International Laboratories, Dept. 25, 809 Fifth Ave., New York.

Big Money selling new Household cleaner. Washes and dries windows. Sweeps, scrubs, mops. Complete outfit less than brooms. Over 100 percent profit. Harper Brush Works, 160 3rd St., Fairfield, Iowa.

Students, Agents. Bamboo self filling fountain pen, stylus point, improves with use, writes like a pencil, no blotter necessary, guaranteed one year. Retails $1.25, sample 65c. Central Supply & Mfg. Co., Dept. R136, Bucyrus, Ohio.

Agents Wanted to advertise our goods and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 2135 American Bldg., Cincinnati, O.

Business Opportunities

Make $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarka, 813 Washington Blvd., Chicago.

Advertise, hundred magazines, three issues, 10c word. Pennell Company, Covington, Kentucky.

A Radio Distributor will shortly earn an outstanding position in the Radio field as distributor for a traveling radio receiver which is unique in every detail, and which can be operated without a single adjustment. Thousands now in use and for sale in Chicago and New York. State or territorial rights will be granted together with liberal advertising and merchandising aids. Write at once for full particulars. Address George D. Lynn, 1844 Broadway, New York City.

Free. Operate little Mail Order business home evenings. Beginner's Outfit furnished containing specialties, 500 circulars, samples. Also tell you how to get Agents sell your specialties. Instructive Book Free. Pier, 798 Cortland Street, N. Y.

Airplane Engineering, under the Western Airplane Corporation method of practical home training, offers you a chance to be successful and become a leader in this newest industry. Written for the Airplane industry by airplane men, this up-to-date Course is offered to you for the First Time after training hundreds of successful Mechanics and Engineers. Write for catalog. Western Airplane Corporation, Dept. R, Monadnock Block, Chicago.

150 Money-Making Plans Free! Wolverine Bureau, R.N.1, Muskegon, Michigan.

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Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 833 of this issue. Chemical Institute of New York, 66 West Broadway, New York City.

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Used correspondence courses of all schools sold, rented and exchanged. List free. (Courses bought). Lee Mountain, East Chattanooga, Tenn.

Educational

Join our home study club and save over 50 percent on new or used correspondence courses. Particulars free. Courses bought. Students' Exchange, Dept. A, 47 West 42nd, New York.

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The International Radio and Business Language. Complete Textbook and 1800 Word Dictionary for $1.00. Your money returned if you are not satisfied. W. A. Buchheim, Bookseller, 1435 Race Street, Denver, Colorado.

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For Sale

$55.00 Western Electric 10-D speakers, $20.00. Earl Wright, Colecamp, Mo.

Storage "B" Batteries at dry cell prices. Purchase a rechargeable "Hawley" storage "B" battery. Non-sulphating or buckling of plates which means clearer enjoyable reception with unlimited life. Sold in complete knock-down units which require no former experience to put together. My unconditional guarantee of return of your money fully protects you. These units contain everything for the actual construction of battery such as large size tested Edison elements, special molded flat bottom glass cells (not ordinary test tubes) punched insulating fibre board for supporting cells, rubber stoppers, special annealed nickel wire, perforated hard rubber separators, full strength chemical electrolyte. With all orders there is included an 8-page illustrated folder, showing simple putting together, making of charger and charging. Also details how to adapt your "A" battery charger if you have one for charging this "B" battery. Prices of units complete as above—22 volts $2.95, 45 volt $5.75, 90 volt $8.95, 100 volt $9.95, 120 volt $11.60, 135 volt $12.75, 150 volt $13.90, 200 volt $17.50. Special voltage units put up at no increase in price. Complete sample cell 35c prepaid. Complete "B" battery charger at $2.50. Extra special 100 volt cabinet of whitewood at $2.75. Also "A" batteries at attractive prices. Order direct or write for my literature, 30 day trial offer and guarantee. Orders shipped same day as received. No waiting. B. R. Smith, 31 Washington Ave, Danbury, Conn.

Health

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League, Box M, Omaha, Neb.

Help Wanted

We Want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton St., New York City.

All Men, Women, Boys, Girls, 17 to 65 willing to accept Government Positions $117-$250 traveling or stationary; Write Mr. Ozment, 251, St. Louis, Mo., immediately.

Detectives Needed Everywhere. Travel. Experience unnecessary. Write George Wagner, former Government Detective, 1968 Broadway, N. Y.

Men to Build Radio sets for me in spare time. Leon Lambert, 595-H Kaufman Bldg., Wichita, Kansas.

Become a Landscape Architect. Uncrowded profession of wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Write for book. American Landscape School, 11-E, Newark, New York.

Languages

World-Romic System, Masterkey to all languages. Primers, $1.94; Chinese, French, Spanish. Pronunciation-Tables, 30c. Languages, 8 West 40th, New York.

Miscellaneous

Spoken Esperanto for Beginners—Prepare for worldwide radiocasting! A direct method manual for teacher and classes, 92 pages, illustrated, $1.00 buys 1 cloth—or 2 paperbound, postpaid. N. W. Frost, 12 Ash Pl., Cambridge 38, Mass.

Old established Export Company with many foreign offices wishes to represent in Australia and other foreign markets best radio equipment and parts. Correspondence solicited. Write C. F. Box 195, Radio News.

Music Composed to words. Bauer Bros., (formerly of Sousa's Band), Oshkosh, Wisconsin.

Beautiful registered bull pups cheap. Bulldogs. 501 Rockwood, Dallas, Texas.

Motorcycles, Bicycles

Don't Buy a Bicycle Motor Attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Patents

Inventions Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 278, St. Louis, Mo.

Patent Attorneys

Patents. Send drawing or model for examination and report as to patentability. Advice and booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, N. W., Washington, D. C.

Lacey Patent-Sense. **See page 844.**

Inventors—Should write for our Free Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our Free Examination and Instructions. Radio, Electrical, Chemical, Mechanical and Trademark experts. Terms reasonable. Victor J. Evans & Co., 922 Ninth, Washington, D. C.

Patents—Send for form 'Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 269 Ouray Bldg., Washington, D. C.

Patents for Inventions. Long experience, highest grade work, rates reasonable, best references. Advice as to patentability. Wm. Ashley Kelly, 41 Park Row, New York.

Personal

Lonesome—Join our club—make acquaintances everywhere. Big illustrated book with descriptions and photos, sent in plain wrapper for ten cents. Bonafide Co., Dept. 58, Kansas City, Mo.

Exchange cheery letters with new friends. Write Betty Lee, Inc., Box 820 City Hall Station, New York City. Stamp appreciated.

Free to Men or Women—Information of a scientific nature that has brought physical vigor and happiness to thousands. No charge; no obligation. Write Fair Sales Co., Dept. 246A, Colorado Springs, Colo.

Lonely Hearts—Exchange letters; make interesting new friends in our jolly club. Eva Moore, Box 908, Jacksonville, Florida. Enclose stamp.

Printing

Twelve Radio Name Cards—Artistic hand work. Send name and quarter. Lloyd Miller, 1140 Hamilton Street, Allentown, Pa.

Radio

2650 Miles Distance with one tube. Any Novice understands our Simplified instructions. Big free booklet tells the story. Vesco Radio Co., Box RC-117, Oakland, Calif.

Four tube great volume, distance set made to order $50.00; hook-up 50c. Robert Seliger, 959 Frankford Ave., Phila., Pa.

Radio Tube Repairs, like new. U.V.200, 201A, 199, etc. $2.25; 202—$3.50. Service and Satisfaction guaranteed. S. Strobel & Co., 3923 N. 6th St., Phila., Pa.

Magnavox M4 Latest nationally advertised reproducers. Magnetically balanced. Sensitive. Improved rubber cushioned diaphragm. List $25. Introductory $21. Storage battery Type R3 with electrical modulator. List $35. Introductory $28. The factory sealed carton is your guarantee. Radio Central, Dept. R, Abilene, Kansas.

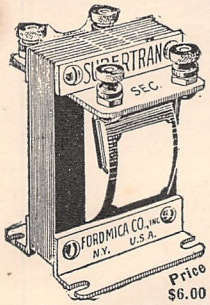
Transmitter for sale complete $60. Cyril E. Reche, Big Pine, Calif.

Teaches you the code within two hours or money refunded. Radio Code chart $1. John Percival, 1412 N. Nevada, Colorado Springs, Colorado.

SUPERTRAN

Registered U. S. Patent Office

An Insulated Audio



Price $6.00

A brand new scientifically prepared Mica compound, insulating the core laminations, eliminates the howling and squealing so prevalent in **ordinary audio transformers.**

Supertran transformers are specially designed for the Neutrodyne and Reflex circuits. Instructive booklet free on request.

Can be used with any amplifying tube on the market with excellent results

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The Beckley Ralston Co., Chicago

Manufactured by

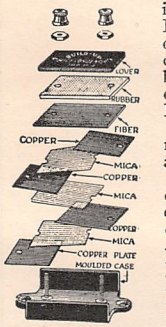
Ford Mica Company, Inc.

33 East 8th Street New York

BUILD-UP

MICA CONDENSER

Patent Pending



insure high efficiency and the Build-Up feature enables the operator to obtain any definite capacity from .00025 to .006 by simply adding extra plates of copper and mica to the Build-Up base.

Each alternate copper and mica plate has a capacity of approximately .0002 Mfd.

Build-Up Mica Condensers of the following capacities, each assembled complete in carton:

.00025	Mfd. List price	50c
.0005	Mfd. List price	50c
.001	Mfd. List price	55c
.002	Mfd. List price	60c
.0025	Mfd. List price	65c
.005	Mfd. List price	70c
.006	Mfd. List price	75c

Extra envelope containing 20 copper and mica plates, or sufficient to build up a condenser from .00025 to .006, list price 25c.

Table showing required number of plates needed for any capacity is furnished with each condenser.

Ask your dealer — or order direct.

APPROVED RADIO NEWS LABORATORIES 1922

CHAS. SCHINDLER

1401 W. Delaware Ave., Toledo, Ohio

Die-Cast Wood CLEARSPEAKER *Glorify* Reception

Surely—you would not expect Kreisler, the master, to give full expression to his art with a **metal** violin! It must be **wood**!

Likewise, a loud speaker must be wood—if it is to reproduce with absolute fidelity and tone correctness.

Die-Cast Wood CLEARSPEAKERS Glorify reception. Get one and know what real radio enjoyment is—from a speaker made of wood, as ours are made.

Crystal Black or Brown

$17.50 COMPLETE

If your dealer cannot supply you, order direct.

COMPRESSED WOOD CORP.
Formerly American Art Mache Co.
343 W. Austin Ave. Chicago

Radio (Continued)

Black Fibre Panels, nicely finished 3-16" thick. Cut to order any size, .01c sq. in. Immediate shipment prepaid. Panel Supply, Box 306, Lowell, Mass.

Panels—Black fibre, 3/16" thick .01c sq. in. prepaid. High dielectric strength. Panel Supply, Box 306, Lowell, Mass.

Radio Generators: 500 volt 100 watt $28.50. Battery charging Generators $8.50. High Speed Motors—Motor Generator Sets all sizes. Motor Specialties Co., Crafton, Penna.

Make Your Neut Reach Out—Same panel, same layout, fewer parts. Our $5.00 Kit includes the one different part, 22 feet real gold sheathed wire, lithographed print of Kladag Coast to Coast Circuit, and complete, simple instructions. Nothing else to buy. Gives selectivity with deep, resonant volume. Not obtainable elsewhere. We originated this and can name scores of buyers it has delighted. Satisfaction Guaranteed. Details—10c. Kit prepaid anywhere, $5.00. New 48-page catalog, thousands of items, many exclusive for stamp. We accept postage stamps same as cash. Kladag Radio Laboratories, Kent, Ohio.

Ivory Radio Panel: Grained white "Ivorilite" makes most beautiful set of all. Guaranteed satisfactory. Any size 3-16" thick sent prepaid 3c per square inch. Sample free. E. P. Haltom, Dept. N, 614 Main St., Fort Worth, Texas.

Radio Books, Catalog free. R. Dobbins, 146 W. 27th St., Indianapolis, Ind.

Radio Fans and B C L's qualify one week—150 students now licensed—Their learning records on request. Complete method $2.50. Dodge Radio Shortkut, Dept. N, Mamaroneck, N. Y.

Increase enjoyment of your set. Send $5.25 for 12 lesson code records. Play on any Victrola type machine. G. Clouser, Williamstown, Penna.

New and reclaimed radio parts, also a few slightly used sets. Ray Baskerville, Symerton, Ill.

A Special on Atlas Loud Speakers $25 regular, our price while they last $12.00. 301 Type tubes—$3.60. Amateur Radio Supply Shop, 525 Park Ave., Kent, Ohio.

One tube Reflex cost me $40. Complete for $28.00. Ayan, 1515 Monroe Street, Chicago, Illinois.

Send me your burned out or broken Power tubes—50 watts or over. Will pay liberally. W. Baker, 36 W. 20th St., New York City.

Have your broken and burned out Power tubes repaired, 50 watts or over. Send them to us for Repair. Charges reasonable. Wm. Baker, 36 W. 20th St., New York City.

Reflex Circuits—Erla, Acme, Wesco and others. Complete kits of parts for building reflex sets. Individual parts or complete assemblies. Tubes do double duty, giving twice the range and volume per tube. One tube reflex operates loud speaker. Complete kits of parts as low as $14.95. For distance, clearness and economy, Build a Reflex. We are reflex specialists. Wesco Radio, 2162 N. California Ave., Chicago, Illinois.

Salesmen Wanted

A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000 ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 66-R West Broadway, New York City.

Salesman calling on jobbing trade to carry our Radio Knock-down Cabinet as a side line. State full particulars. Strictly confidential. Box 190, Radio News.

Salesmen for nationally advertised popular priced line of all-wood radio loud speakers. Men calling on radio trade. Liberal commission paid weekly. Replies confidential. Advise territory. Compressed Wood Corporation, 345 West Austin Ave., Chicago.

Bradley earned $1658.00 last month. You can too. Ask us to show you. Flashtric Sign, 2126 Hudson, Chicago.

Were You Ever Offered a Grocery Store? Our proposition is better. You can handle flour, canned goods, dried fruit, coffee and entire line of groceries as well as radio sets, paints, roofing and automobile oils and tires with no rent to pay; no money invested; take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Co., Dept. 204 Chicago, Ill. Reference: Any bank or Express Company.

Scenery to Rent

Settings for Opera, Plays, Minstrels. Plush Drops. Address Amelia Grain, Philadelphia.

Stamps and Coins

California gold. Quarter size 27c; half-dollar size 53c; Half-dime and Catalog 10c. Norman Schultz, Colorado Springs, Colo.

158 Genuine Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents wanted. Big 72-p. Lists Free. We buy stamps. Estab. 20 years. Hussman Stamp Co., Dept. 146, St. Louis, Mo.

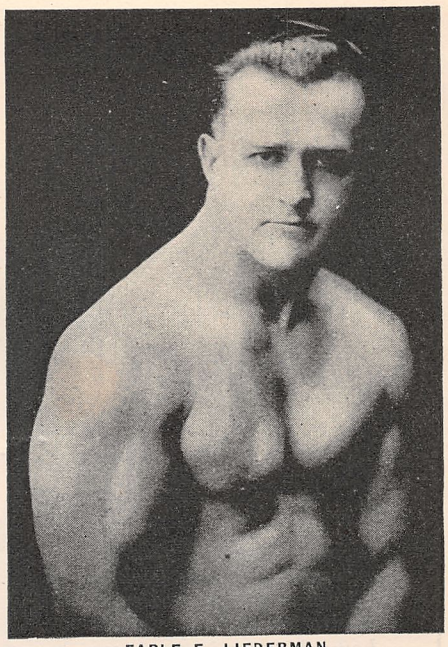
French Colonies Free—Beautiful Picture Set, Native Chiefs, Tigers, Pictorials. 2c postage. Empire Stamp Company, 346 Lippincott, Toronto, Canada.

Telegraphy

Telegraphy—Both Morse and Wireless taught thoroughly. Big salaries. Wonderful opportunities. Expenses low: chance to earn part. School established fifty years. Catalog free. Dodge's Institute, Cour St., Valparaiso, Ind.

Wanted to Buy

Full Value Paid for Old Gold, Jewelry, Watches, Diamonds, crowns, bridges, dental gold, silver, platinum, gold or silver ore; magneto points, old false teeth. Packages returned if our offer is not satisfactory. United States Smelting Works (The Old Reliable) 120 So. State St., Dept. 16, Chicago, Ill.



EARLE E. LIEDERMAN
The Muscle Builder

Do You Need A Bust in the Nose

before you start to fight? Do you need this kind of treatment to bring you to your senses? If you are that kind of a fellow, the chances are strong that you are going to get it.

BE READY

I don't recommend that you be a rowdy who goes around looking for a fight. But I do believe you should be alert and, when the time comes, be prepared to beat the other fellow to the punch.

THE WISE MAN

Some men never pay any attention to the condition of their house till it begins to fall on their head. Others watch for the first sign of a crack and immediately have it put in condition. How about the house you live in—your body? Are you going to let it clog up and waste away until you suddenly realize you have tuberculosis or some other dreadful, incurable disease? Get wise! Check up on yourself! Put your body in shape and keep it so.

An apple is no good unless you eat it. Let it lie, and it will rot away. Let your muscles lie idle and they will waste away, but **use your muscles and you have more muscle to use.**

"THE MUSCLE BUILDER"

That's what they call me. I don't claim to cure disease. But I do absolutely guarantee to make a strong, husky man out of anyone who will give me a chance. If you wait until some disease gets you, the doctor is the only one who can save you—but come to me now and the doctor will starve to death waiting for you to take sick. I'll put one inch of solid muscle on your arm in just 30 days and two inches on your chest in the same length of time. But that's only a starter. I'll put an armor plate of muscle over your entire body and build up the walls in and around every vital organ. I'll shoot a quiver up your spine that will make you glow all over. You will have a spring to your step and a flash to your eye that will radiate life and vitality wherever you go. And what I say doesn't just mean **maybe.** I absolutely guarantee these things. Are you with me? Come on then. Let's go.

Send for my new 64-page book

"Muscular Development"

IT IS FREE!

It contains forty-three full page photographs of myself and some of the many prize-winning pupils I have trained. Many of these are leaders in their business professions today. I have not only given them a body to be proud of, but made them better doctors, lawyers, merchants, etc. Some of these came to me as pitiful weaklings, imploring me to help them. Look them over now and you will marvel at their present physiques. All I ask is 10 cents to cover cost of wrapping and mailing. For the sake of your future happiness, send for your copy today, right now, before you forget it.

EARLE E. LIEDERMAN

Dept. 3611, 305 Broadway, New York City

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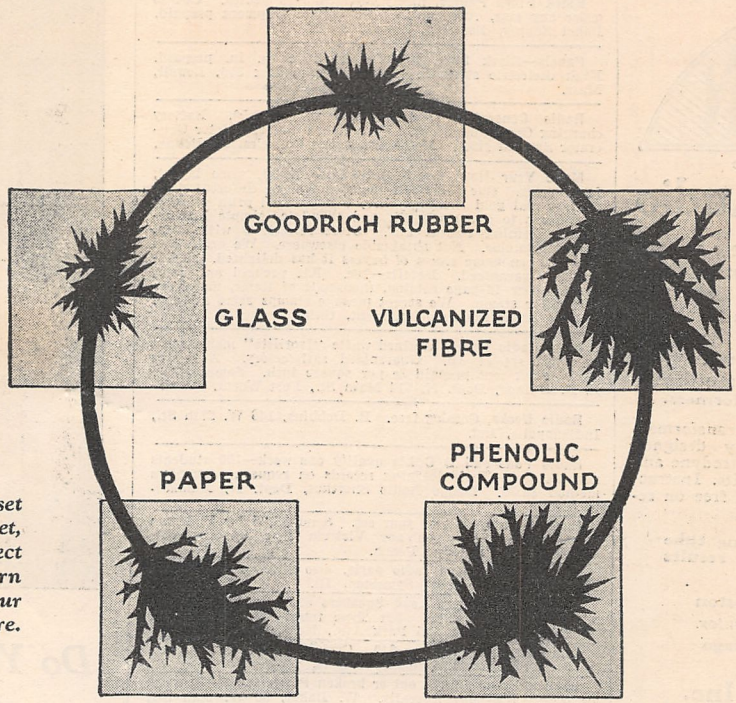
Dear Sir: I enclose herewith 10 cents, for which you are to send me without any obligation on my part whatever, a copy of your latest book, "Muscular Development."

Name .....

Street .....

City ..... State.....

(Please write or print plainly)



Before you build your set write for our new booklet, "Rubber for More Perfect Radio Reception." Learn how rubber can improve your set and add to your pleasure.

Science says use Hard Rubber Panels *to avoid* Dielectric Losses

DIELECTRIC losses reduce range and selectivity. Use hard rubber radio panels in building your set and minimize these losses. Hard rubber—the chart shows—has the lowest dielectric losses.

And more, it is easily worked with ordinary tools—more moisture-proof—and less expensive.

Goodrich Radio Panels give you all basic hard rubber advantages—and more!

¶ Won't warp from the heat of tubes because their softening point is 25° Fahr. higher than that of usual hard rubber.

¶ Permanently retain their rich, glossy finish because of a much lower free sulphur content.

¶ Conserve all electrical properties because of lower moisture-absorption.

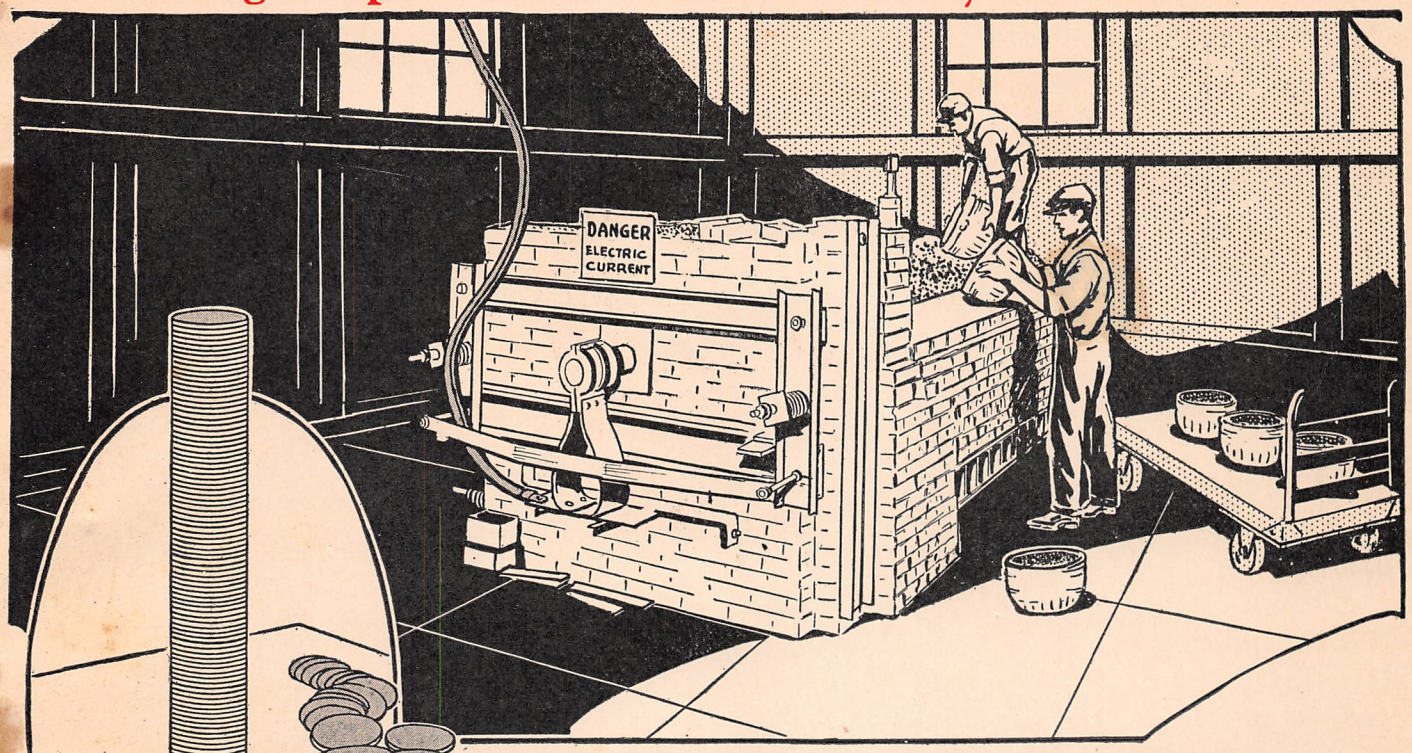
So ask for Goodrich! Two attractive colors—black and mahogany. All standard sizes—individually packed.

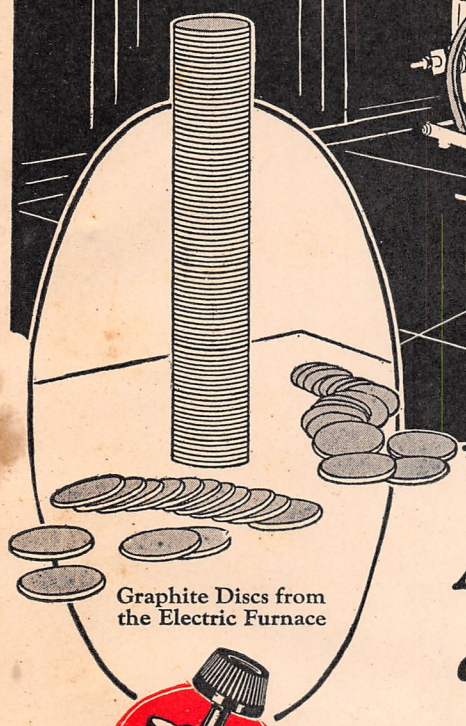
THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio
ESTABLISHED 1870

Goodrich HARD RUBBER *Radio Panel*

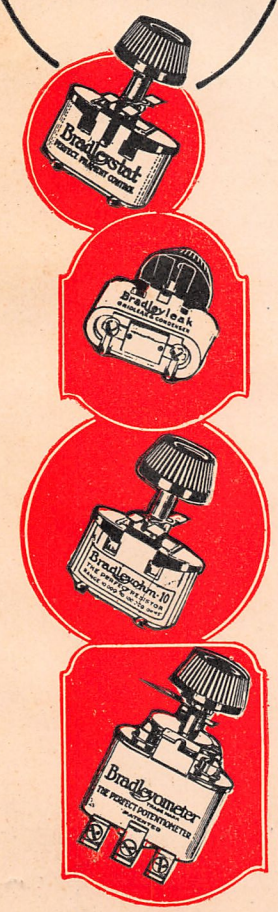
THE PERIODICAL PRESS, NEW YORK

Producing Graphite Discs in Allen-Bradley Electric Furnaces





Graphite Discs from the Electric Furnace



Allen-Bradley Radio Products are the best insurance against trouble

FINE, stepless control is not the only distinctive feature of Allen-Bradley graphite disc radio devices. It is true that with no other type of rheostat can you enjoy the noiseless, stepless, selective control of the Bradleystat. No adjustable grid leak can equal the Bradleyleak.

But there also is the inherent reliability of the graphite discs, produced in the terrific heat of the electric furnace, and encased in porcelain containers that cannot warp. Atmospheric changes mean nothing to graphite discs. Corrosion cannot destroy them. Continuous use cannot impair their perfect operation.

The slight extra cost of Allen-Bradley radio products is an insignificant premium on insurance against interrupted radio reception. Think this over! The quality endures after the price is forgotten.

Allen-Bradley Co.
Electric Controlling Apparatus
287 Greenfield Ave. A-B Milwaukee, Wis.

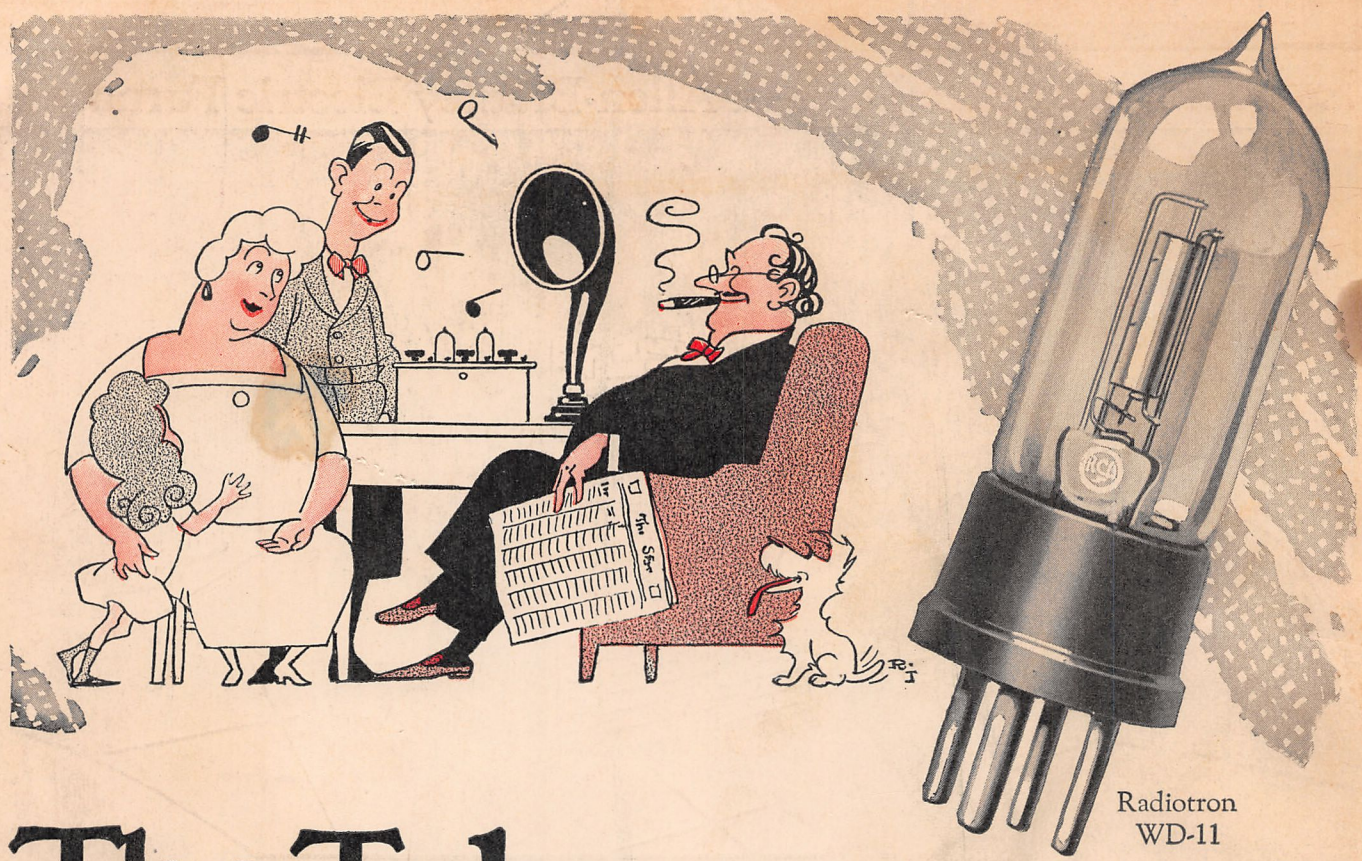
Manufacturers of Graphite Disc Rheostats for more than 20 years

ALLEN BRADLEY CO.
287 Greenfield Av.
Milwaukee, Wis.

Please send me descriptive leaflets on Allen-Bradley radio products.

Name.....

Address.....



Radiotron
WD-11

The Tube *means* Music or Noise

Buying anything but the best in vacuum tubes is like trying to run a car on gas that is half water. In radio, everything, in the end, depends upon the Radiotrons. You can put perfectly good Radiotrons in a poorly made set—that's true. But the point is that the very finest receiver made can be no better than its tubes. This is no new or startling announcement. Everyone knows it. And that's why, at the radio counter, you see each man pick up a Radiotron, and look at the base for the word "Radiotron", and at the glass for the "RCA" mark. For best reception — real music—nothing short of the best in tubes will do.

RCA

This symbol of quality is your protection

It isn't a genuine **WD-11** unless it's a **Radiotron.**

It isn't a genuine **WD-12** unless it's a **Radiotron.**

It isn't a genuine **UV-199** unless it's a **Radiotron.**

It isn't a genuine **UV-200** unless it's a **Radiotron.**

It isn't a genuine **UV-201-a** unless it's a **Radiotron.**

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